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ABSTRACT

To gather longitudinal student achievement data from schools utilizing the four-day week, Iowa Tests of Basic Skills (ITBS) grade equivalent scores were obtained in 1984 from five rural Colorado school districts for four consecutive years--two years prior to and two years following the districts' change to the shortened week. A first analysis identified two groups of students: one (N=62) provided a sequence starting with grade three and going through grade six, and a second (N=45) started with grade four and went through grade seven. A second analysis examined the performance of a given grade level for each of the four consecutive years for grades three, four, five, and six. Analysis of the ITBS scales revealed that the change to a four-day school week had no effect on student academic achievement, although there was a suggestion that there might be some leveling of performance during the first year the schools were on the four-day schedule. Analysis of the same grade level across the four-year period also provided no clear evidence that the change had any effect on student achievement. The significant differences might be explained by the observation that one year or class of students performs quite differently from another. (BRR)

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Student Achievement in the Four-Day School Week

Dr. Joseph L. Daly
Associate Professor
Department of Education
Colorado State University

Dr. Robert W. Richburg
Professor of Education
Department of Education
Colorado State University

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Office for
Rural Education
Department of Education
Colorado State University
Fort Collins, Colorado 80523
(303) 491-7022

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INTRODUCTION

Over thirty school districts in Colorado, as well as many others throughout the United States, have adopted a four-day school week. By scheduling school for four long days instead of five normal-length days, school officials have been able to trim energy and transportation costs, as well as realize significant advantages in such areas as student and teacher absenteeism.

Despite these favorable results, the jury is still out on the preferability of the four-day schedule, since its effect on the critical area of student achievement has not been determined. In the earliest evaluation research on the four-day school week, Richburg and Edelen (1981) reported that student achievement was unaffected by the conversion to the four-day calendar. The authors cautioned that these findings were tentative, however, because the new calendar had only been in use in these schools for one year, and valid achievement data was very scarce.

Little data on student achievement has been available for evaluations. While almost all school districts have a testing program of some sort, good data is still difficult to obtain. Districts do not all use the same achievement tests, and they do not test the same grade levels or the same subject matter areas in the same years.

When school districts made the decision to go to a four-day school week, they did so in order to address major needs of the district and not as an experiment to provide research data on student achievement. As a result, attempts to obtain good longitudinal achievement data on a group of the same students or data on the same grade level over a number of successive years comes after the fact.

This paper will report the results of a systematic effort to gather longitudinal student achievement data from schools utilizing the four-day week. Despite the difficulties in collecting valid achievement data, substantial longitudinal data does exist and can be used to assess the impact of this alternative calendar on student learning.

PROCEDURE

In the spring of 1984 five school districts in the state of Colorado were identified that were on the four-day school week, and that were using the same achievement test, the Iowa Test of Basic Skills, (ITBS) for at least two years prior to changing to the four-day schedule and at least two years since the change. Data in these districts was reasonably complete across most grades and subject matter areas of the test.

The ITBS provides scores on the following scales and subscales

Vocabulary

Reading Comprehension

Language Skills

- Spelling
- Capitalization
- Punctuation
- Usage

Work-Study Skills

- Visual Materials
- Reference Materials

Mathematics Skills

- Mathematics Concepts
- Mathematics Problem Solving
- Mathematics Computation

Composite

ITBS grade equivalent scores were obtained for students in five rural school districts for four consecutive years--two years prior to and two years following the districts change to a four-day school week. The data on student achievement provided by these scores on the various scales and subscales of the Iowa Test of Basic Skills was then analyzed to determine the effect on student achievement, if any, of the change to the four-day schedule.

The first analysis involved selecting those students for whom data was available for four consecutive years, beginning two years before the change to a four-day school week was made, and continuing for two years after. Two groups of students were identified for this analysis.

One group (N = 62) provided a sequence starting with grade three and going through grade six. The second group (N = 45) started with grade four and went through grade seven.

For both of these groups the mean grade equivalent score for each scale and subscale of the ITBS was computed for each of the four years. The significance of any difference among these four means was then tested using a one-way analysis of variance.* In those instances where a significant difference among the four means was found, the difference between the performance of the groups before and after the change to the four-day week was also tested using the Scheffe method for determining the significance of selected contrasts.

A second analysis examined the performance of a given grade level for each of four consecutive years, two years before and two years after a change to the four-day school week. Data was available for four consecutive years for grades three, four, five and six.

---

* Since the purpose of the analysis of variance was to determine if there was any significant change in the relative level of performance of the group from one year to the next independent of the growth reflected in moving from grade to grade, a constant reflecting the norm for the month in the school year in which the test was administered was subtracted from the mean for that year. Since the tests were administered in April of each year, the constant was 3.8 for grade three, 4.8 for grade four, 5.8 for grade five, and 6.8 for grade six.

The mean grade equivalent for all students in a given grade was computed on all scales for each of the four years. A one-way analysis of variance was then used to test the significance of any differences among the four means. If a significant difference was found using the analysis of variance, the Scheffe method was used to determine if there was any significant difference in performance before and after going to a four-day school week.

RESULTS

Analysis One

Analysis Performance of the Same Students for Four Years as Compared to Grade Norms

Tables 1 through 6 summarize the performance of the same sixty-two students compiled from the five rural school districts over a four-year period beginning with grade three in Vocabulary, Reading Comprehension, Language Skills, Work-Study Skills, Math Skills, and a Composite. The ITBS was administered to these students twice while they were studying under the five year schedule--once in April of their third grade year and again in April of their fourth grade year. Then, as these five districts changed to the four-day calendar, the students were tested in April of their fifth and sixth grade years.

An examination of these six graphs reveals some noteworthy consistencies. The analysis of variance used to analyze the data in each graph yielded significant F scores for two subtests and the Composite. This indicates that in these three cases two or more means differed significantly. When a Scheffe Test was used as a follow-up in order to compare the average of the two means for student achievement under the five-day schedule with the average of the two means under the four-day schedule, there was no significant difference on any of the scales. In other words, while there may be significant differences in student achievement from year to year, these differences had nothing to do with whether students are going to school four or five days a week.

Another interesting pattern emerges when Tables 1-6 are considered together. For the Composite (Table 6) and Tables 2, 3 and 5, the year wherein the students made the smallest achievement gains was the first year on the four-day week. While achievement overall is just as high under the four-day week as under the five, there seems to be a small but noteworthy slump in achievement the first year that the four-day week is in operation. There may be many plausible explanations for this. It could be, for example, that the initial adjustment that students and teachers must make to the four-day week creates some disruptions in student achievement. While noting this repeating pattern, it is important to reiterate the

conclusion that after two years on the four-day schedule, achievement is virtually identical to the achievement these students registered while going to school five-day weeks.

An examination of each of these subtests individually also reveals interesting information about the achievement of the sixty-two students. Table 1, for example, summarizes these students' understanding and retention of vocabulary. They begin the four-year sequence two-tenths of a grade above their grade level norms and end the four-year sequence four-tenths of a grade above the norm. In contrast with the general pattern noted in the discussion above, the greatest achievement gains for this group of students occurred during the first year on the four-day week.

Table 2 portrays these students' performance on reading comprehension. This scale measures the students' ability to remember factual detail that they have read and to recognize relationships and inferences. In this scale the students begin the four-year sequence four-tenths of a grade point above their grade level norm. They are in virtually the identical situation at the end of the four year sequence being five-tenths of a grade above the norm. The slump in achievement for the first year on the four-day week that was discussed above is clearly seen in this data. The students only gained

TABLE 1
VOCABULARY - GRADES 3-6
Performance of Same Students
Compared to Grade Norms

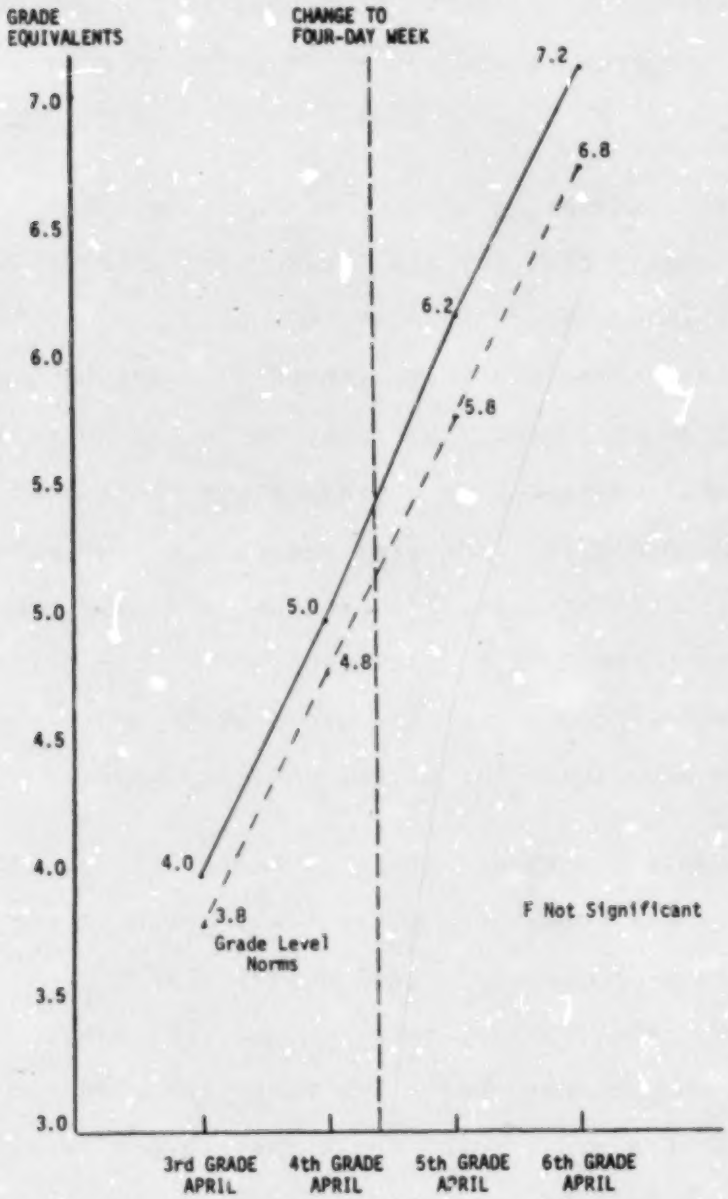
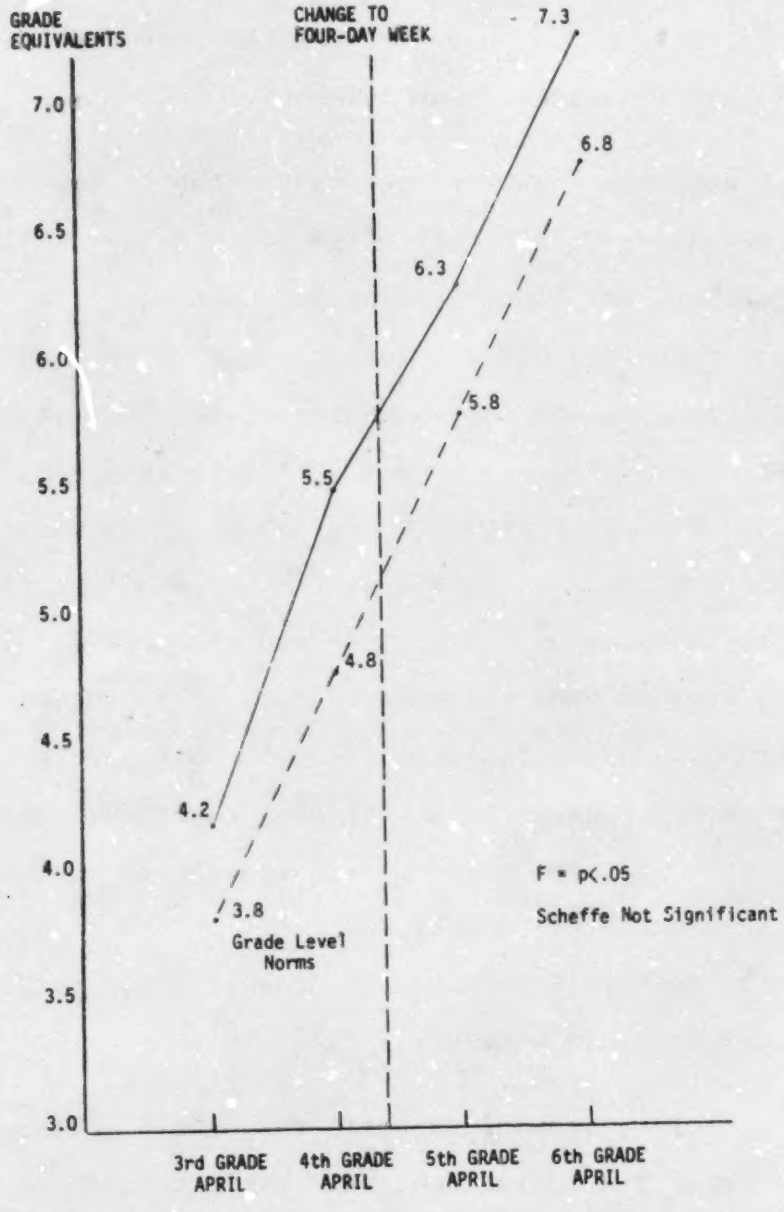


TABLE 2
READING COMPREHENSION - GRADES 3-6
Performance of Same Students
Compared to Grade Norms



eight-tenths of a grade level for the fifth grade year--the first year on the four-day schedule. There is no other year in the sequence when the students gain less than one full year in achievement.

As Table 3 summarizes, this group of students performed above grade level norms in language skills throughout this four-year period. In April of the third grade year they would be expected to score about 3.8 in grade equivalents (shown by the dotted line on the graph), and they are actually scoring at 4.1. At the end of the four-year sequence when these students are completing their sixth grade year, they would be expected to register about a 6.8 grade equivalency, and in fact they show an average score of 7.0. The language skills scores follow a similar pattern to that seen in Table 2. The smallest gains in achievement in Language Skills was eight-tenths of a grade level, registered between April of the fourth grade year and April of the fifth grade year. Again, this is the first year those students were on the four-day schedule.

Table 4 summarizes work study skill achievement. The pattern here is identical to the pattern exhibited by these students in vocabulary achievement (Table 1). The students were two-tenths of a grade level above grade level norms at the beginning of the sequence, and four-tenths above the norms after the four year sequence. In this subtest, as with vocabulary achievement, the

TABLE 3
LANGUAGE SKILLS - GRADES 3-6
Performance of Same Students
Compared to Grade Norms

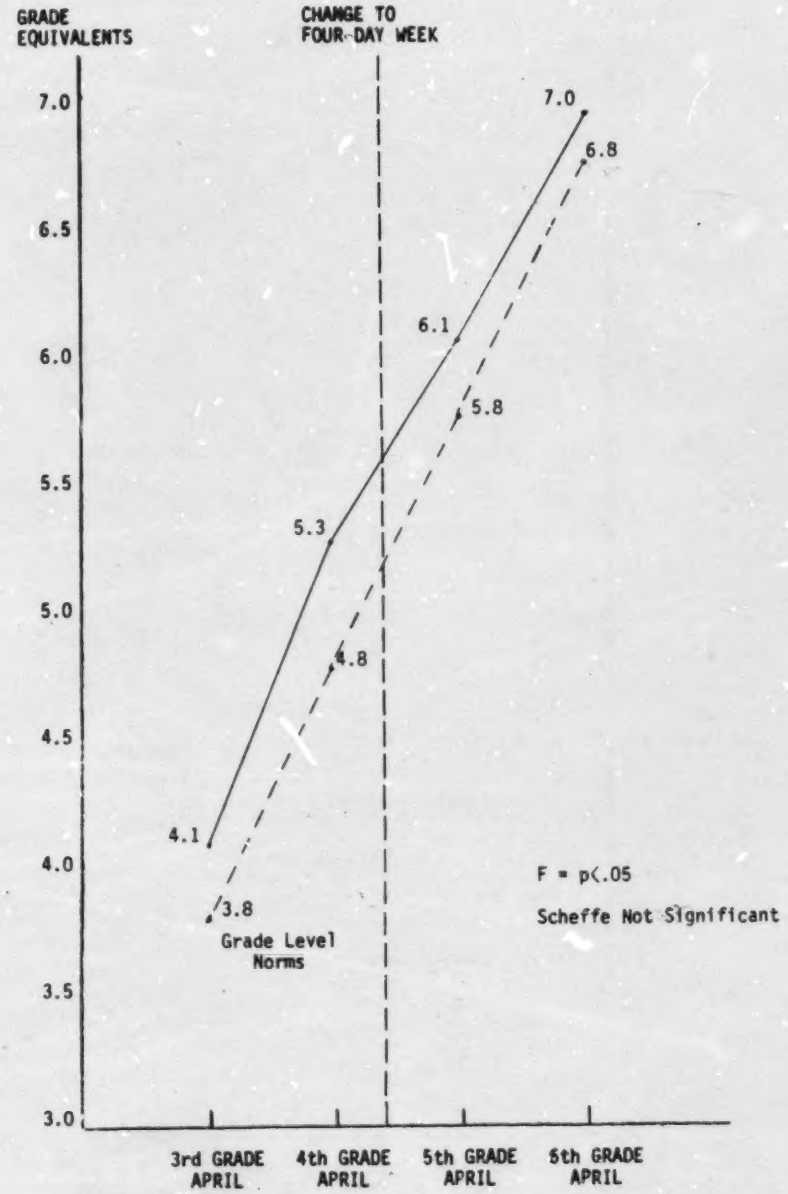
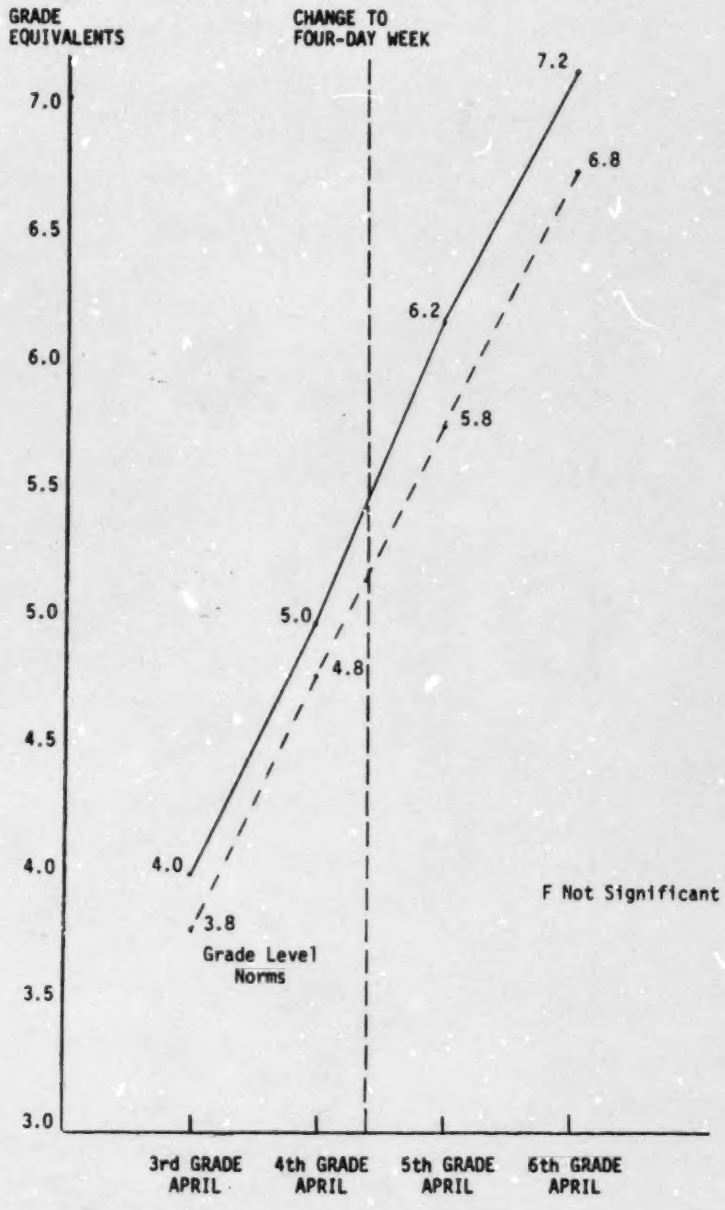


TABLE 4
WORK-STUDY SKILLS - GRADES 3-6
Performance of Same Students
Compared to Grade Norms



greatest achievement gains were posted during the first year in which the four-day schedule was used in these schools. This counters the prevailing pattern.

Math skills achievement is summarized in Table 5. Here the achievement scores are virtually identical to their grade norms throughout the four year sequence. As has been the pattern with the other tests, there is no statistically significant difference between the math achievement on the five-day week and that on the four-day week.

The final data to be considered in this sequence is a Composite score, graphed in Table 6. This represents a synthesis of the data from the first five tables. The F statistic again indicates that two or more means differ significantly from each other in the analysis of variance, but the subsequent Scheffe test indicates that there is no pattern of achievement related to the number of days the students were in school each week. They scored as well on this combined measure of achievement when going to school four days as they did going to school five. Once again, however, the smallest gains in achievement were made during the first year on the four-day schedule.

As was mentioned earlier, a second set of sequential achievement data paralleling that shown in Tables 1-6 was collected for another group of forty-five students from

TABLE 5
MATHEMATICS SKILLS - GRADES 3-6
Performance of Same Students
Compared to Grade Norms

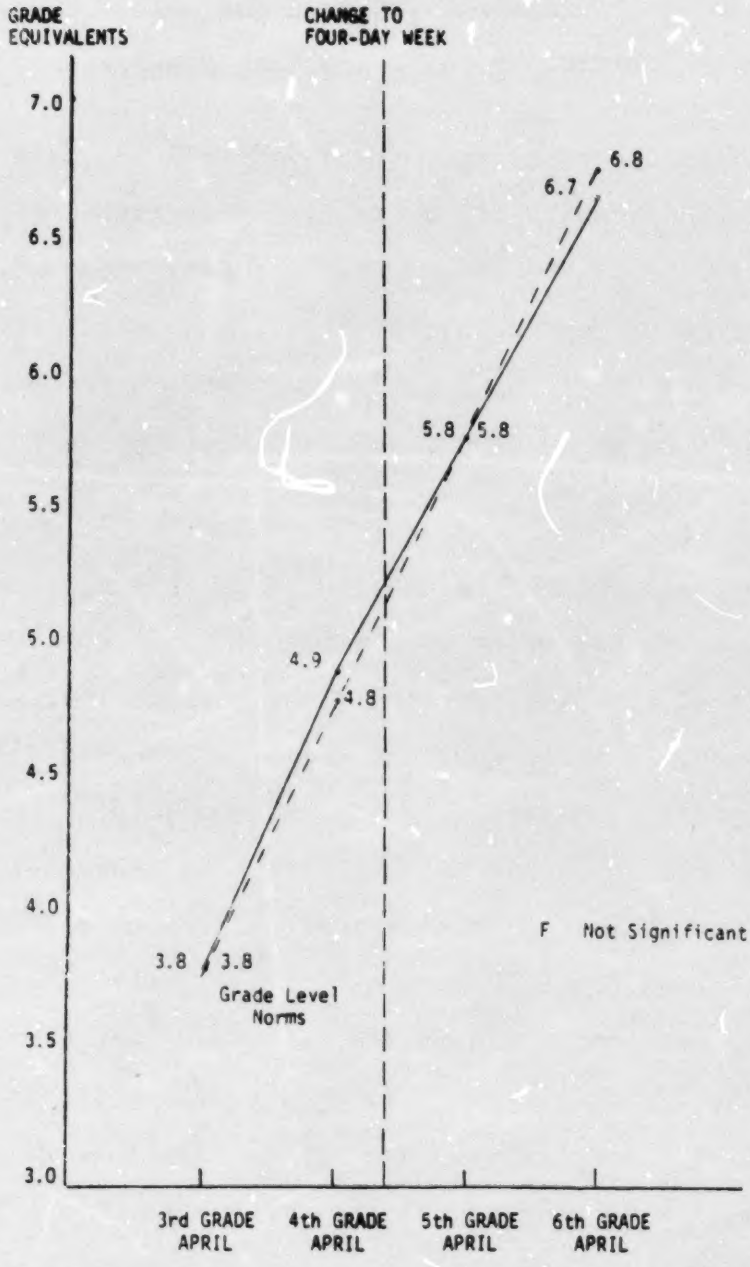
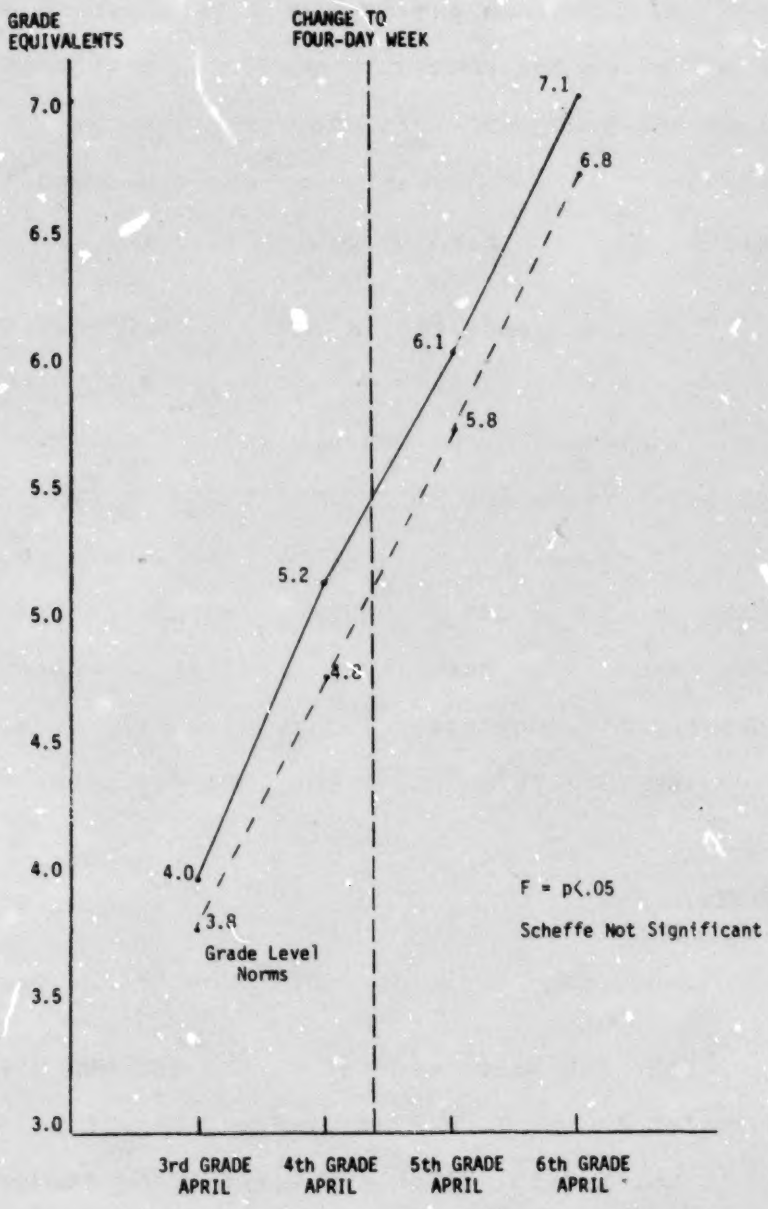


TABLE 6
COMPOSITE - GRADES 3-6
Performance of Same Students
Compared to Grade Norms



these same five schools. In this case the achievement patterns were monitored from the spring of their fourth grade years through the spring of the seventh grade year. Table 7 shows the composite performance of this second set of students over this four-year period. The other test scores that together comprise this composite are included in the Appendix (Tables 8 to 12).

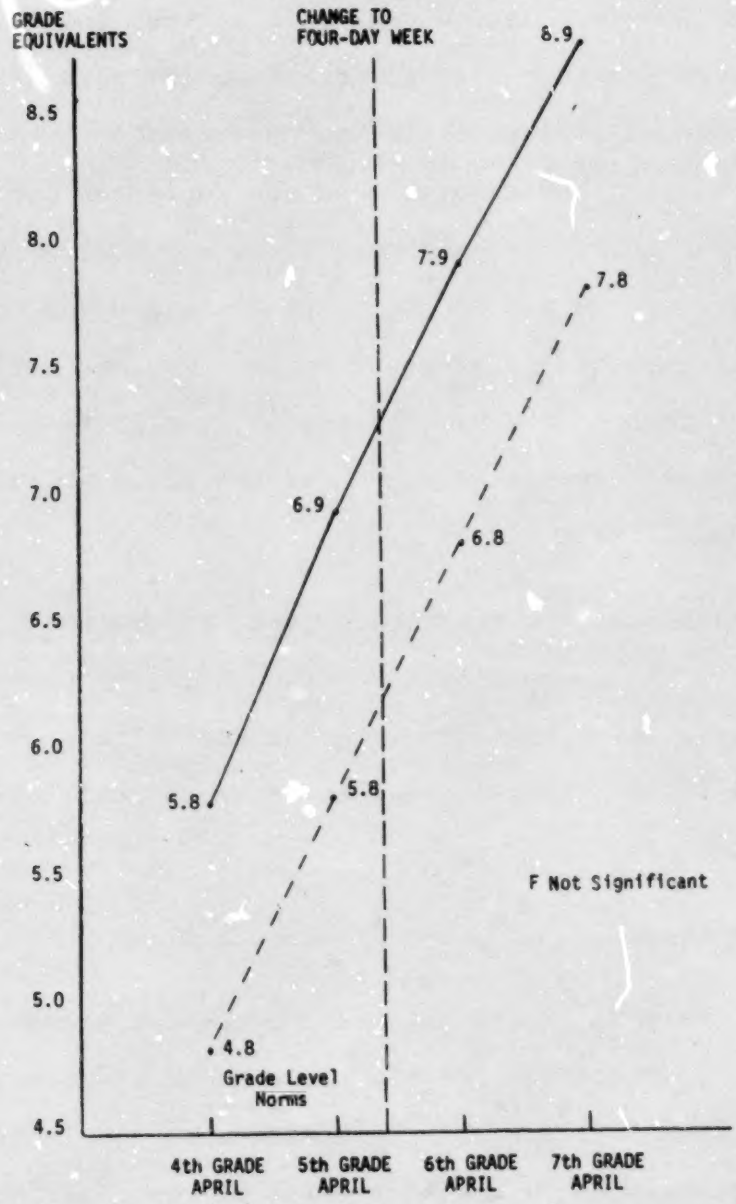
The data summarized in Table 7 corroborates the findings already discussed. This group of students is a higher achieving group but the pattern of their achievement is very similar to the first group. They begin the four-year sequence a full grade level above their grade norms. They end the sequence 1.1 grades above their grade norms. The gains they register in achievement under the five-day schedule are virtually identical to the gains registered under the four-day schedule.

Analysis Two

Same Grade Level for Four Consecutive Years

Grade equivalent scores on the various scales and subscales of the Iowa Test of Basic Skills were available for third, fourth, fifth and sixth grade students for each of the four years, beginning two years before the five rural districts changed to the four-day schedule, and continuing for two years after the change was made.

TABLE 7
COMPOSITE - GRADES 4-7
Performance of Same Students
Compared to Grade Norms



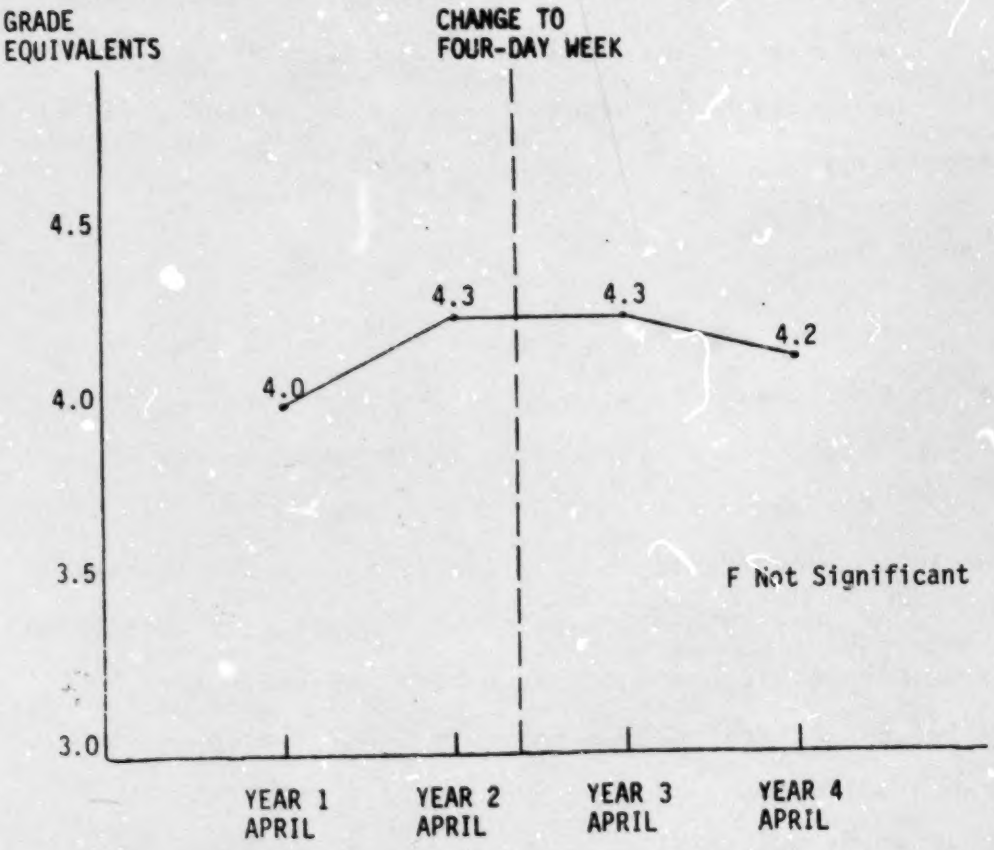
Mean grade equivalents on all scales and subscales of the ITBS were computed for each grade level for each of the four successive years. A one-way analysis of variance was then used to determine if there was any significant difference in the performance of the students at a given grade level across the four-year period. If significant differences were found across the four years, the Scheffe method for selected contrasts was then used to determine if achievement in the two years prior to the change in schedule was significantly different from the achievement demonstrated in the two years following the schedule change.

The data for each grade level across the four successive years was analyzed for each of the tests and subtests which together with the Composite score, make a total of 15 different analyses at each grade level, three through six.

Third Grade

Analysis of the composite score for Grade three is shown in Table 13. No significant differences were found among the four means. There were also no significant differences among the four means on the other five main scales of the ITBS (Vocabulary, Reading, Language Skills, Work-Study Skills, Mathematics Skills) at this grade level. Summaries of these scales can be found in the appendix in Tables 14-18.

TABLE 13
COMPOSITE - THIRD GRADE
Achievement Across Four Years



While none of the major scales showed any significant differences, it should be noted that in the analysis of the subscales, significants Fs (.01) were found on the Capitalization and Punctuation subscales of the Language Skills test. The difference between years 1 and 2 and years 3 and 4 was also significant with the last two years being higher. See Tables 19 and 20 in the appendix.

Fourth Grade

The analysis of the Composite score for the fourth grade achievement data is presented in Table 21. There are no significant differences in the mean scores of fourth graders across the four-year period for this scale. Among the other main scales summarized in Tables 22 to 26 (see appendix), only the Reading test showed any significant differences. Even here, however, the selected contrast comparing years 1 and 2 with years 3 and 4 was not significant (Table 23). This indicates that while there may be year-to-year differences in reading achievement, the average performance of fourth grade students for the two years before and the two years after the change to the four-day school week showed no significant difference.

Fifth Grade

Summaries of the fifth grade data shown in Tables 27 through 32 once again indicate no significant difference

TABLE 21
COMPOSITE - FOURTH GRADE
Achievement Across Four Years

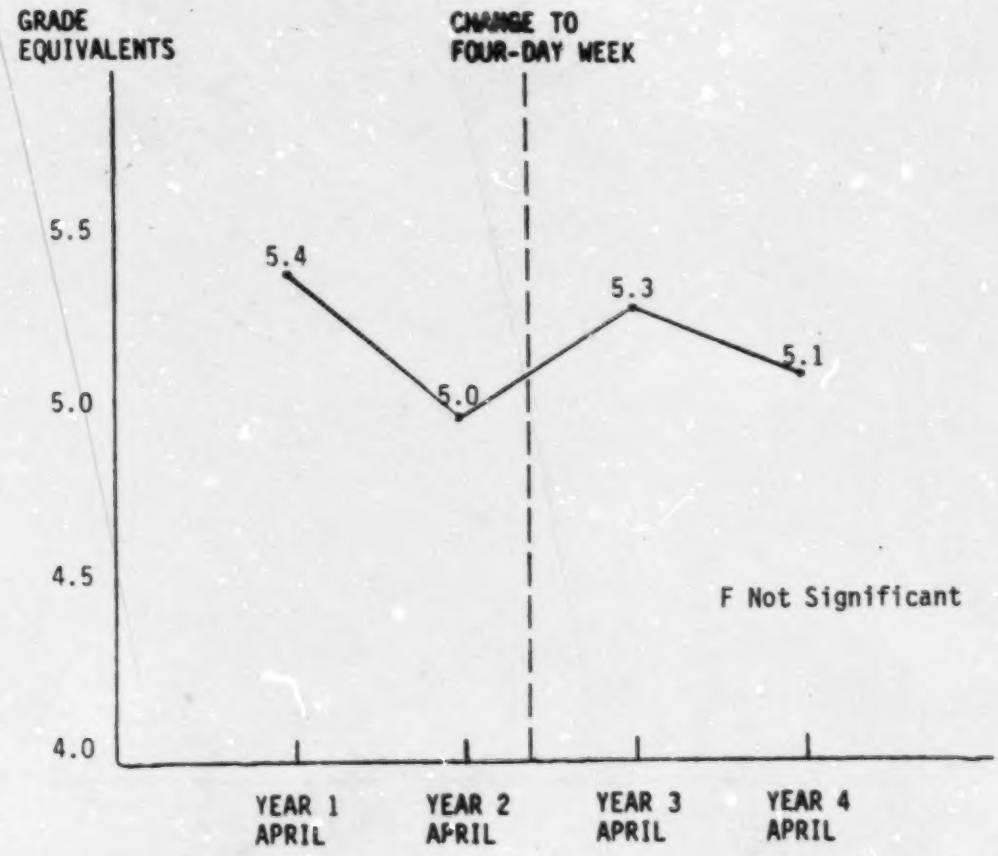
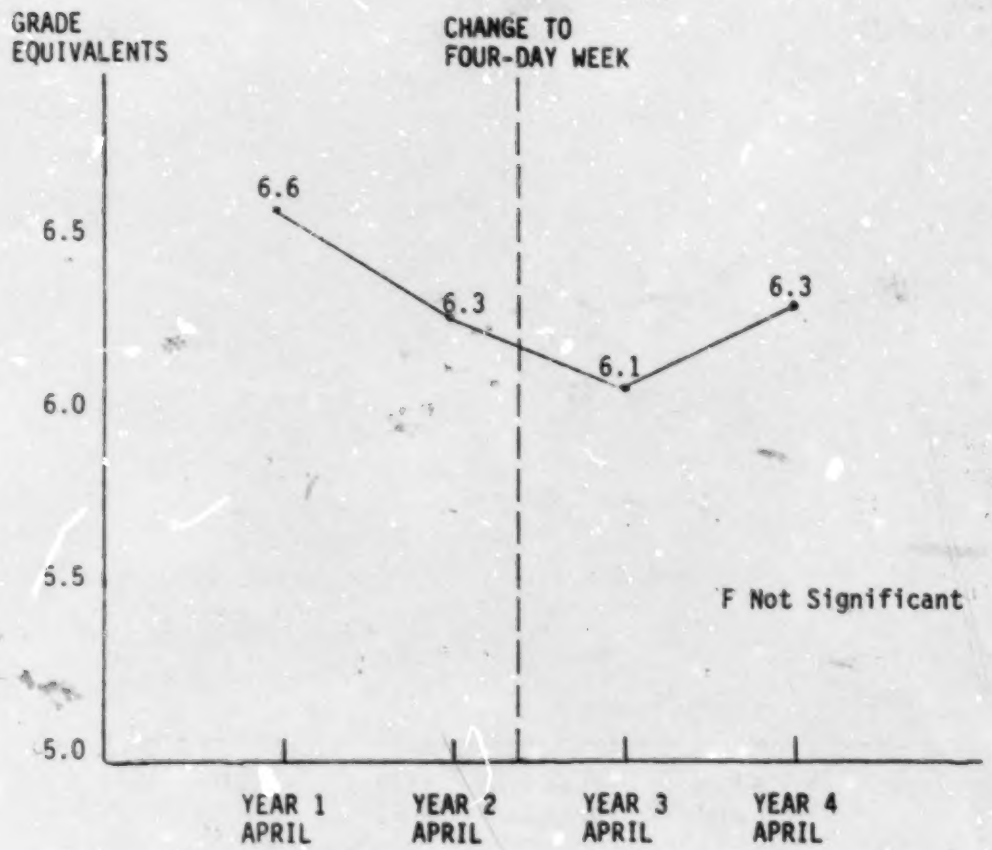


TABLE 27
COMPOSITE - FIFTH GRADE
Achievement Across Four Years



in performance across the four year period, with one exception. In this instance, the exception was the Vocabulary test, where a significant difference among the four means was found. However, again here years 1 and 2 were not significantly different from years 3 and 4.

Table 27 shows the analysis for the fifth grade Composite score. Summaries of the other five scales are included in Tables 28 to 32 in the appendix.

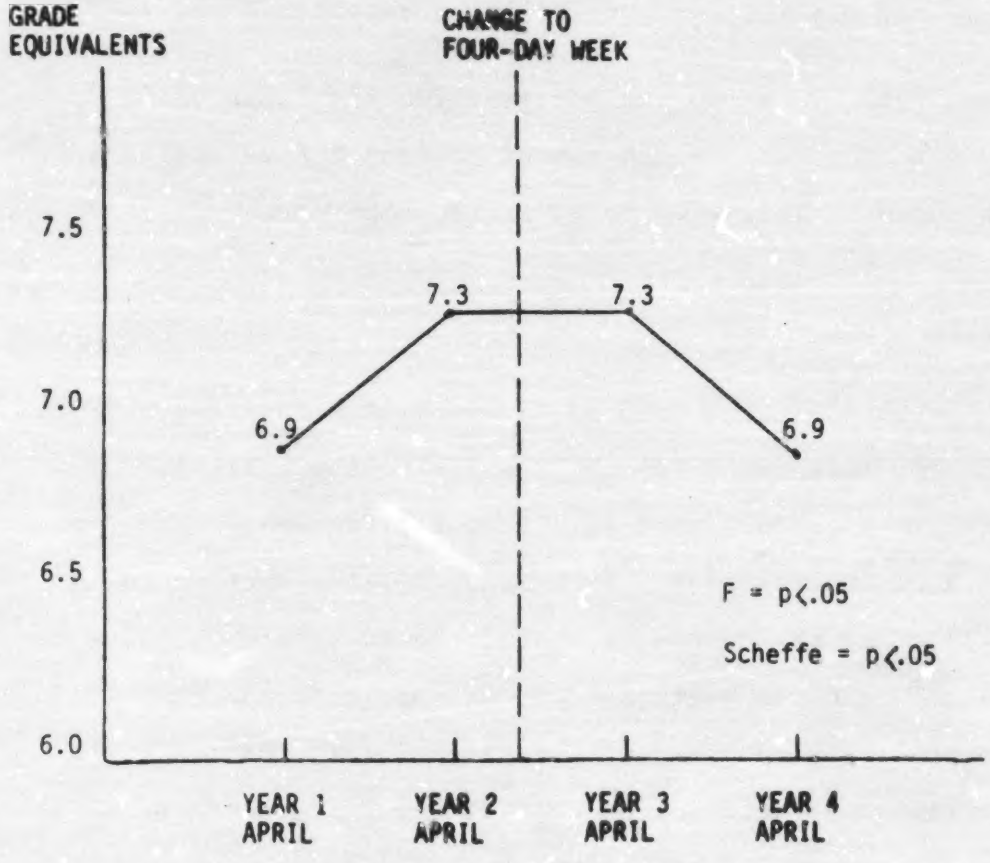
Sixth Grade

Table 33, the Composite, and Tables 34 through 38 in the appendix summarize the results of the analysis for the sixth grade. Here significant differences were found on 3 of the 6 scales: Work-Study Skills, Mathematics Skills and the Composite Scale. However, when achievement in the two years before the change to the four-day schedule was compared with achievement in the two years following the change, no significant differences were found.

SUMMARY AND CONCLUSIONS

It is clear that the overall conclusion to be drawn from the data available on these five rural school districts is that the change to a four-day school week has had no effect on the academic achievement of students as measured by standardized achievement test scores, in this instance the Iowa Test of Basic Skills.

TABLE 33
COMPOSITE - SIXTH GRADE
Achievement Across Four Years



When the same students were followed for four successive years, two years on the regular five-day week and two years on a four-day week, there was no indication that the achievement of these students was affected in any significant way. The performance of the two groups of students was strikingly similar in its pattern, with no significant difference being found between years 1 and 2 and years 3 and 4 on any of the 15 tests and subtests of the ITBS.

However, one observation that comes from the similar pattern of performance for both groups on most of the scales suggests that there may be some slight leveling of performance during the first year that these schools were on the four-day schedule.

Analysis of the same grade level across the four-year period also provided no clear evidence that the change to the four-day school week had any effect on student achievement. With sixty separate analyses (15 scales on each of four grade levels), only two subscales showed any significant difference in the achievement level when comparing the two years before the schedule change with the two years after. While in both instances the difference was in favor of the four-day week, the infrequency of the findings leaves the very real possibility that they may be nothing more than chance occurrences.

In a number of instances (four of twenty-four analyses if one considers only the main scales, fifteen of sixty analyses if one considers all scales and subscales), a significant difference was found among the four years, even though years 1 and 2 were not found to differ significantly from years 3 and 4. A word of comment in explaining these findings: The finding of a significant difference among a number of means does not tell us where those differences are. In this study when such overall differences were found, our main interest was to see if they could be accounted for by differences in performance before and after the change to a four-day school week. In only two instances did this account for the differences that were found. It is only logical then, that the differences must be between some other set or combination of means. Examination of the data shows this to be the case, with no particular set or pattern emerging from the analysis of the various mean contrasts.

In studying school achievement, one variable that does make a difference is year or class. We are well aware that one year or class of students performs quite differently from another. This is true of individual schools and school districts. This seems to be the best explanation of the random differences in classes found in the grade level data, and is supported by a number of additional observations.

First of all, even though the performance of the two groups of students used in the first analysis is strikingly similar in pattern, the second sequence of students clearly performs better than the first group across all scales and subscales.

Second, in the grade level data it is evident that the same patterns of performance of one year in relation to the other years is repeated across almost all scales, and the pattern for each grade level, while similar within that grade, is different from the pattern of the other grade levels.

The data does show that the performance of one class (year) as reflected by achievement test scores can be significantly different in a statistical sense from that of another. This suggests that if one wants to examine the effects of a given program--such as the four-day school week--on the achievement of students in the public schools, it is imperative that longitudinal data over a number of years be examined. Simply looking at any two adjacent years would give very different--and misleading-- results, depending on which two years in a sequence were selected.

It seems clear from this data on the four-day school week that year-to-year differences in classes easily account for those incidents where significant differences among the four means were found regardless of the grade

level or subject matter tested and there is no evidence in the data that indicates the change to a four-day school week had any effect on the achievement of the students.

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Richburg, Robert W. and Sjogren, Douglas D. "The Four-Day School Week: What Are the Advantages for Schools? National Association of Secondary School Principals' Bulletin, 1983, 67, 60-63.

APPENDIX

TABLE 8
VOCABULARY - GRADES 4-7
Performance of Same Students
Compared to Grade Norms

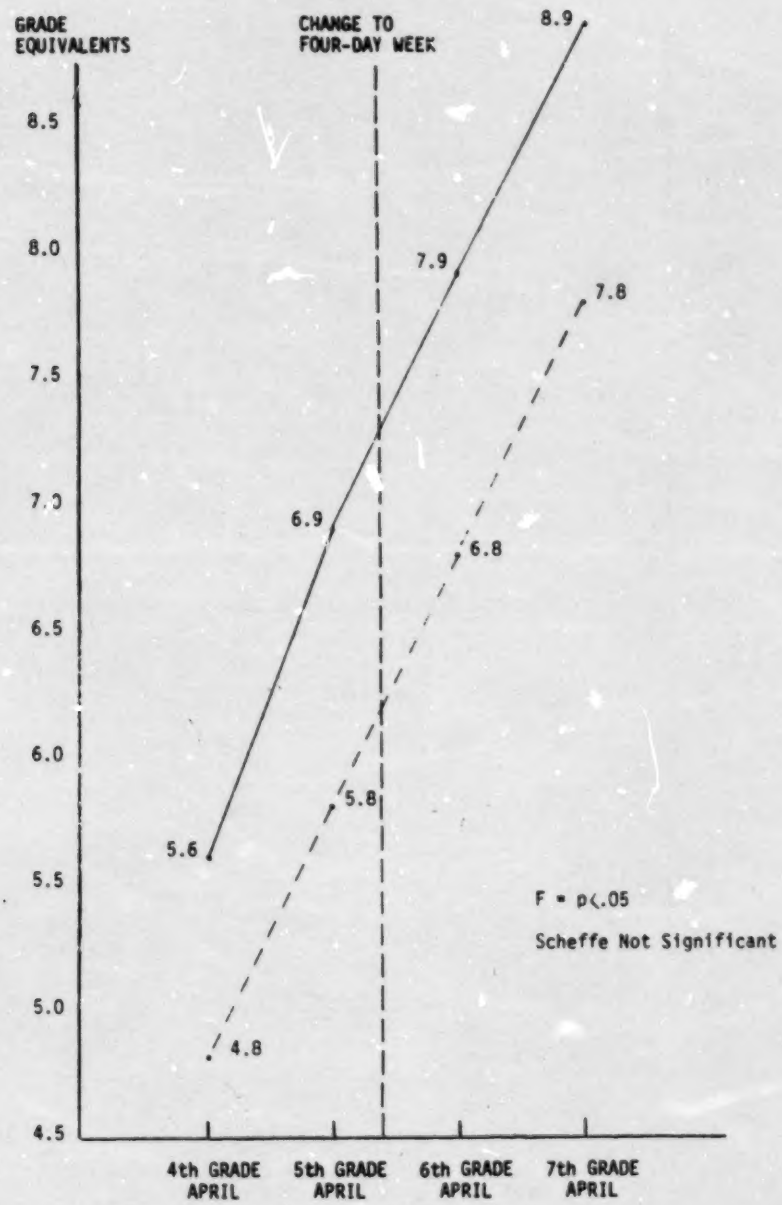

TABLE 9
READING COMPREHENSION - GRADES 4-7
Performance of Same Students
Compared to Grade Norms

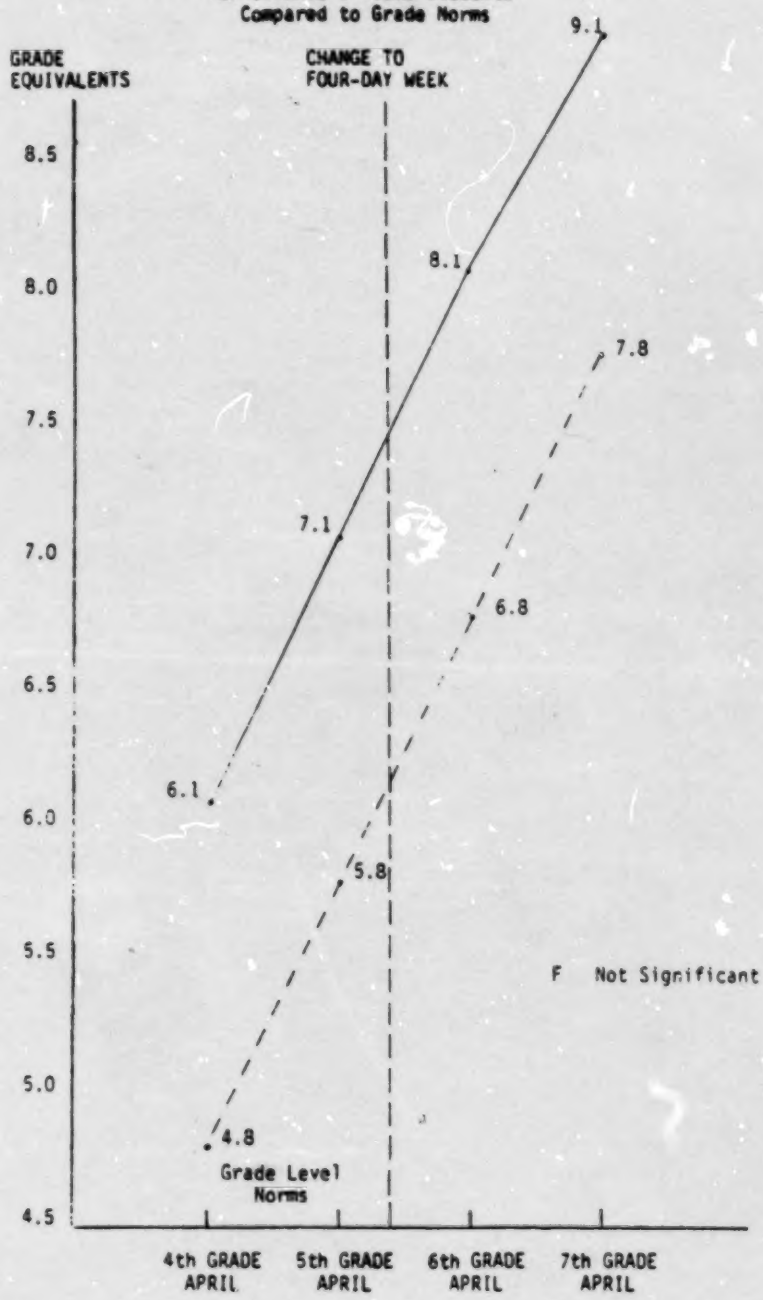

TABLE 10
LANGUAGE SKILLS - GRADES 4-7
Performance of Same Students
Compared to Grade Norms

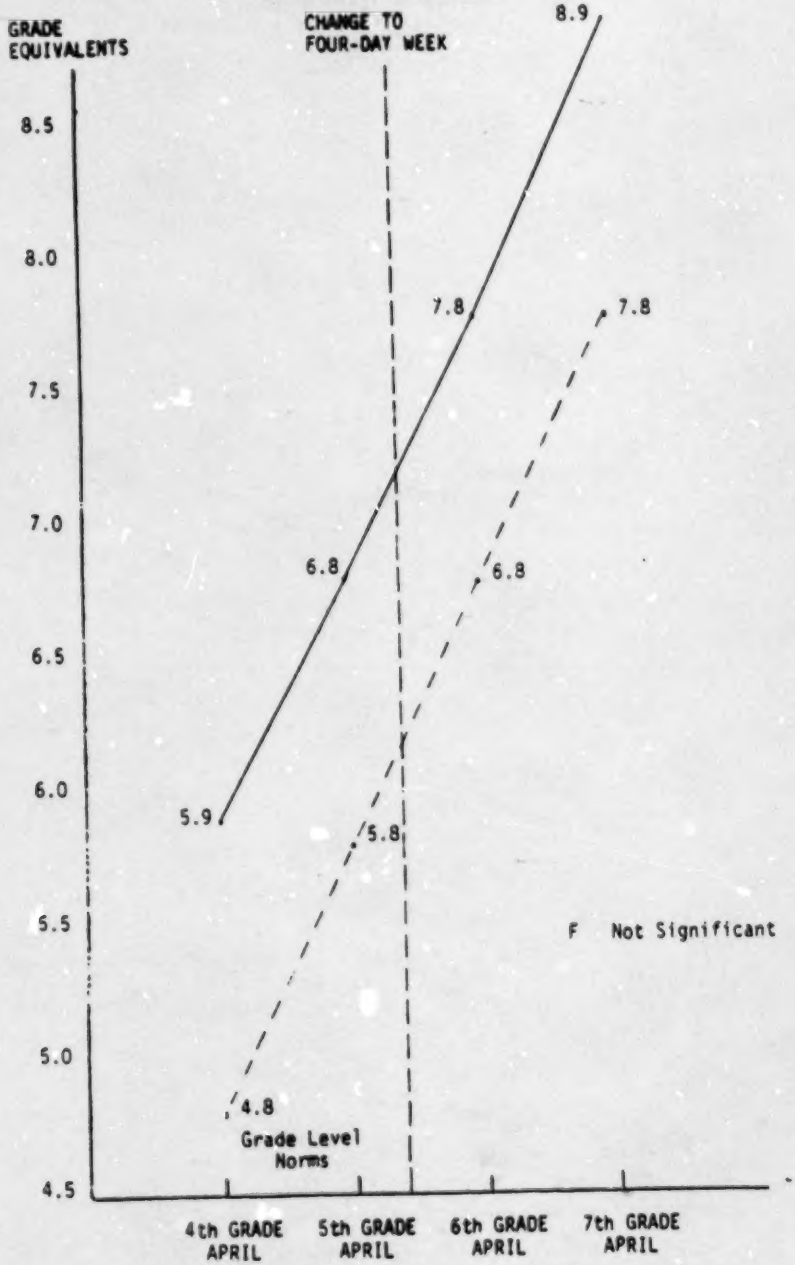

TABLE 11
WORK-STUDY SKILLS - GRADES 4-7
Performance of Same Students
Compared to Grade Norms

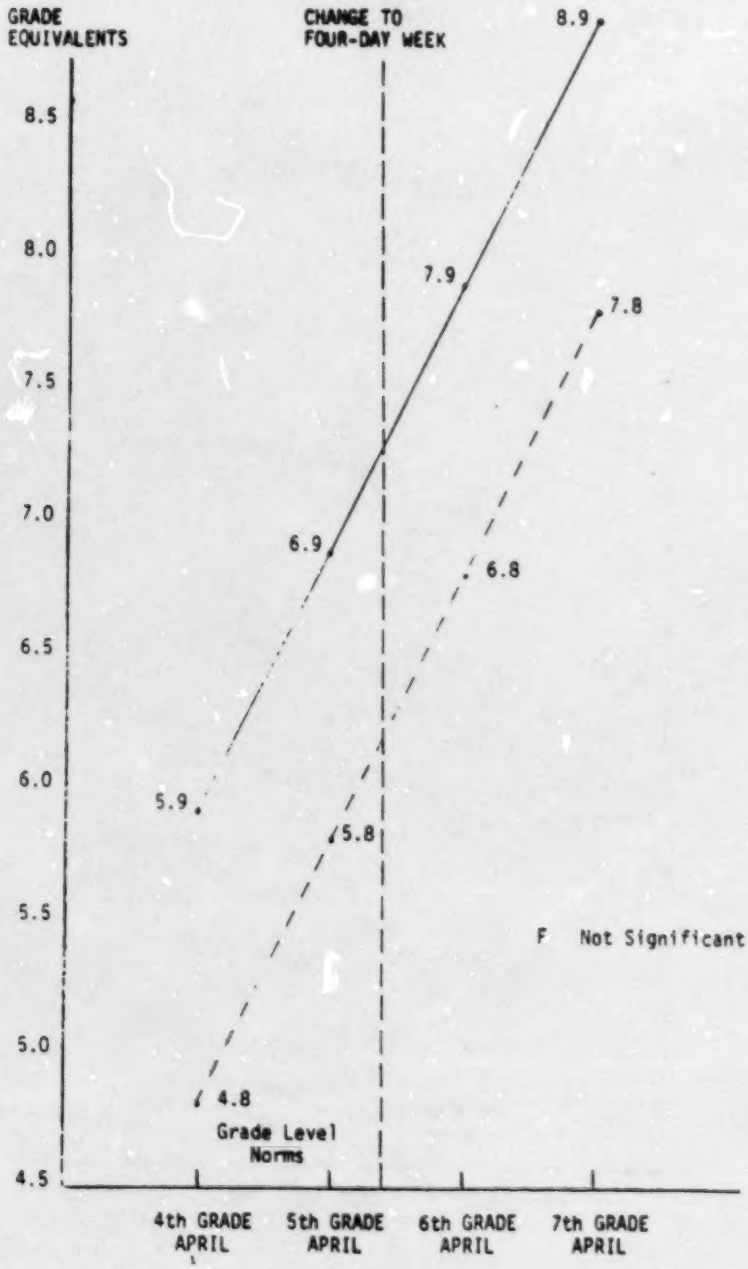

TABLE 12
MATHEMATICS SKILLS - GRADES 4-7
Performance of Same Students
Compared to Grade Norms

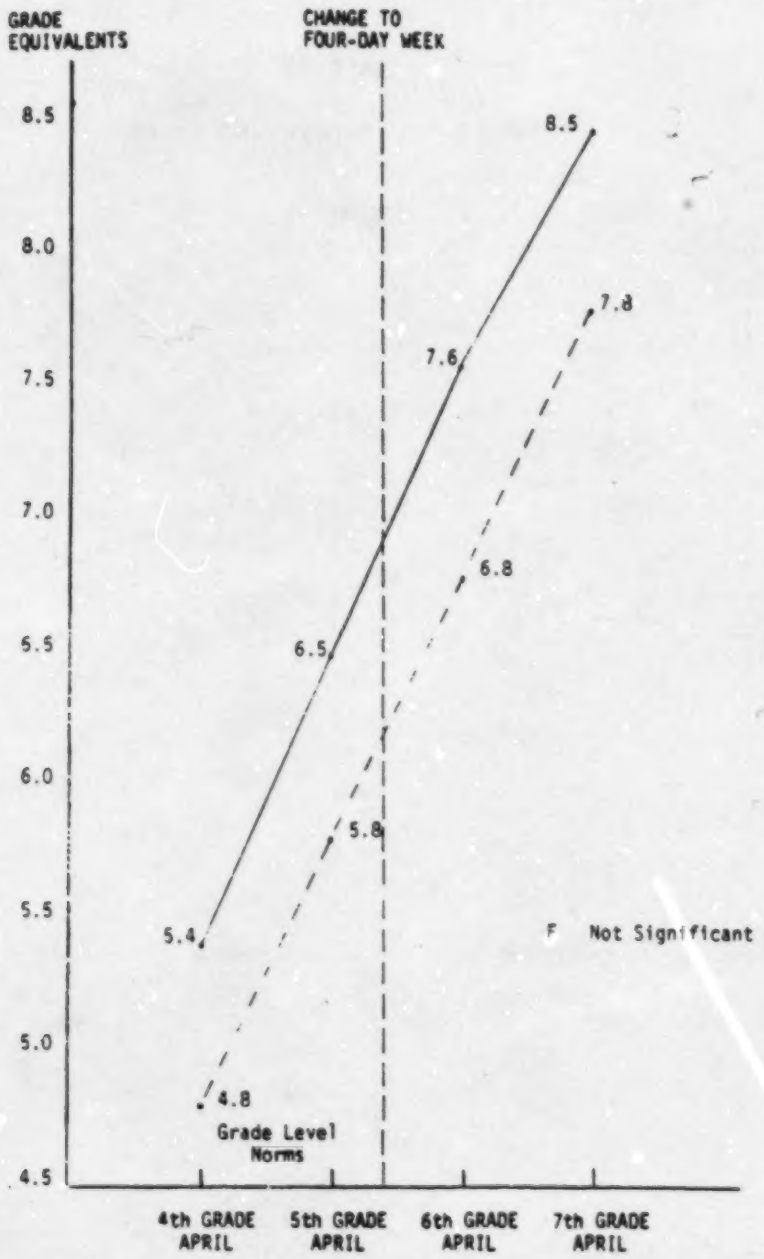

TABLE 14
VOCABULARY - THIRD GRADE
Achievement Across Four Years

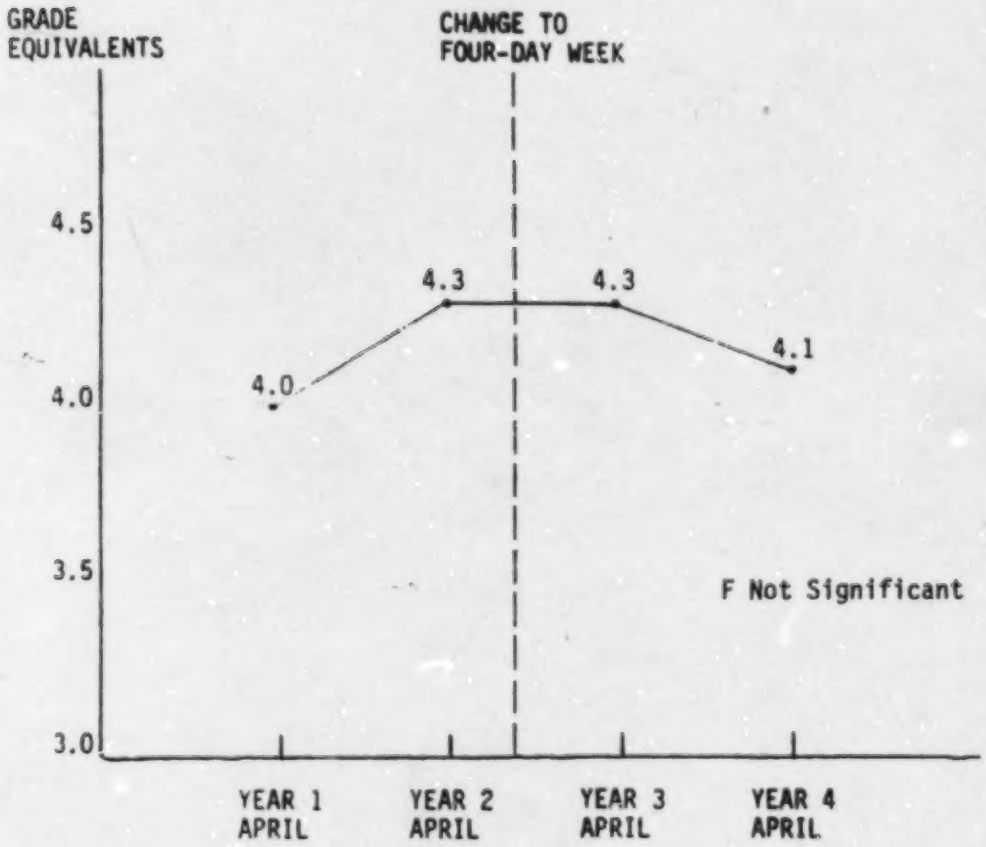

TABLE 15
READING - THIRD GRADE
Achievement Across Four Years

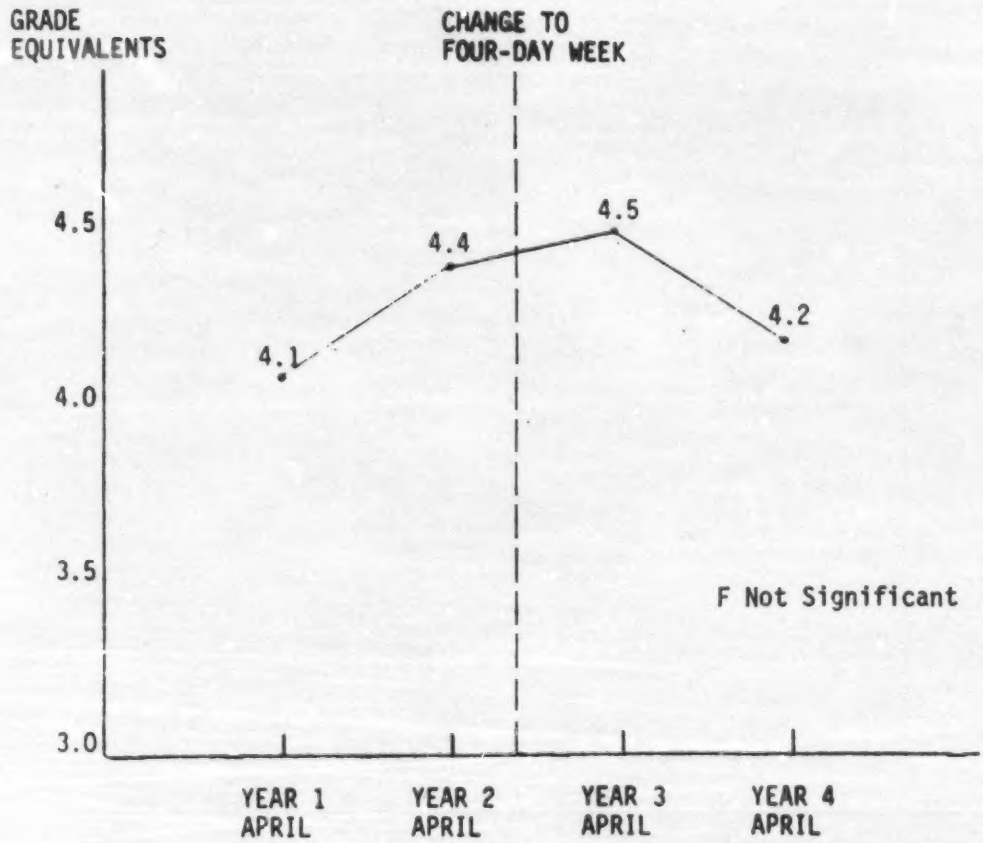

TABLE 16
LANGUAGE SKILLS - THIRD GRADE
Achievement Across Four Years

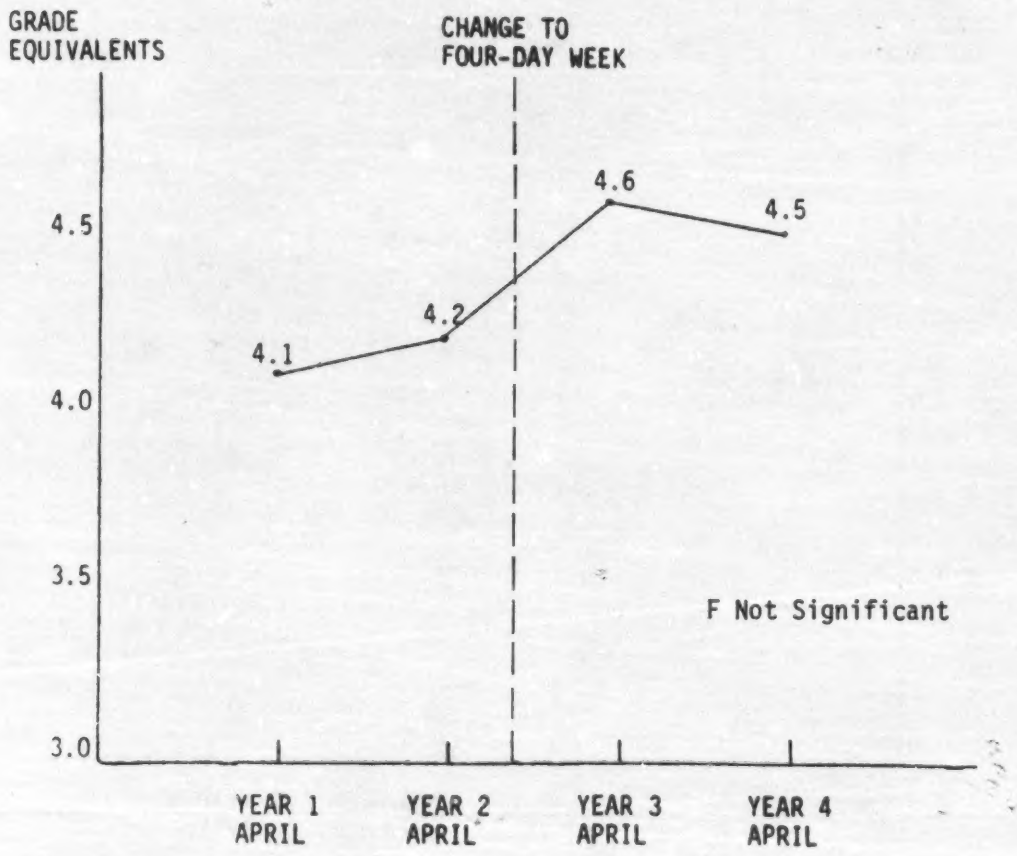

TABLE 17
WORK-STUDY SKILLS - THIRD GRADE
Achievement Across Four Years

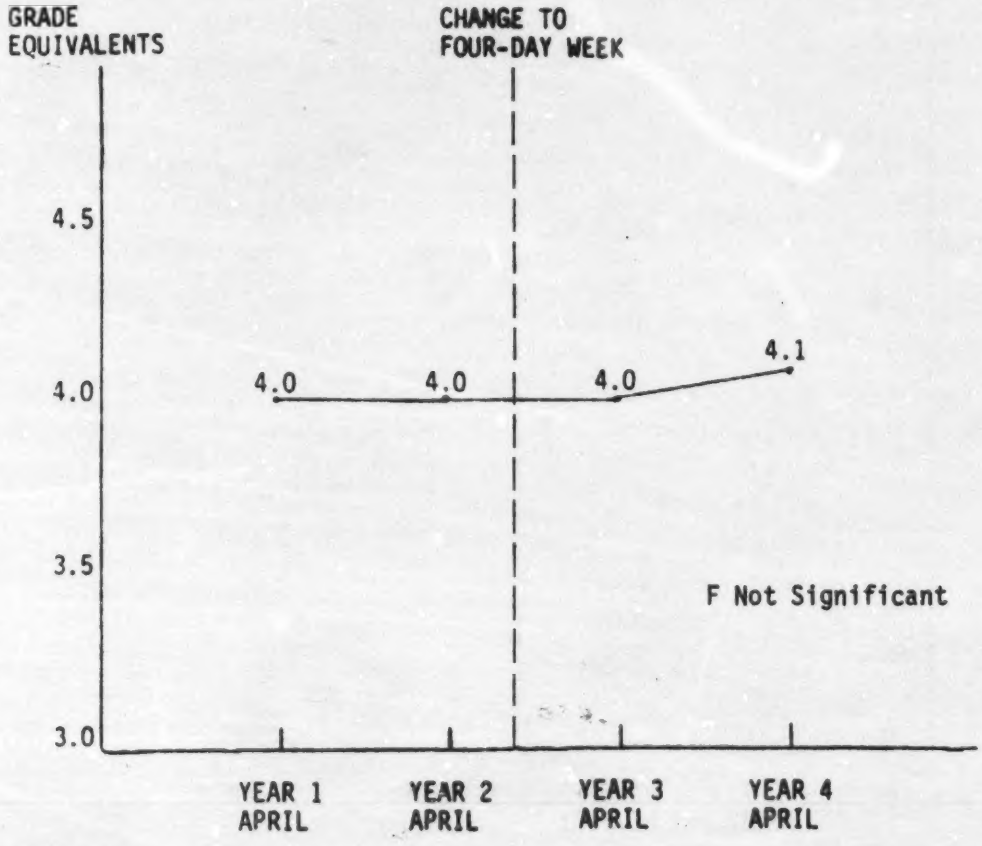

TABLE 18
MATHEMATICS SKILLS - THIRD GRADE
Achievement Across Four Years

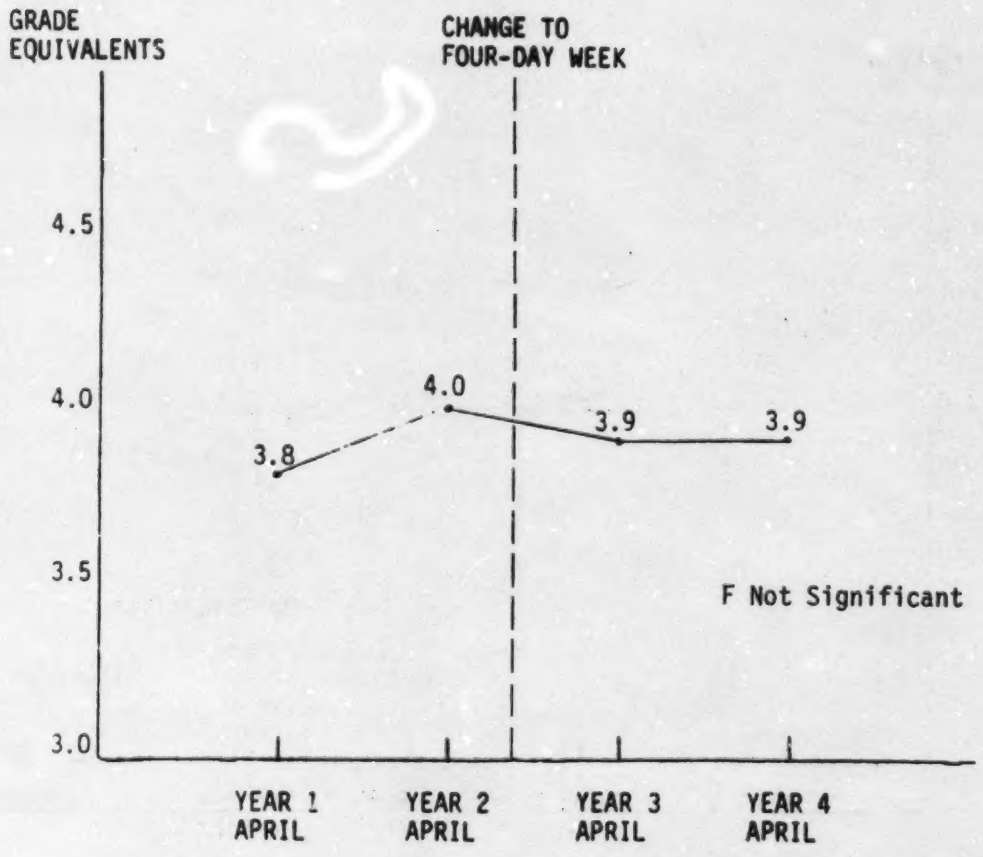

TABLE 19
CAPITALIZATION - THIRD GRADE
Achievement Across Four Years

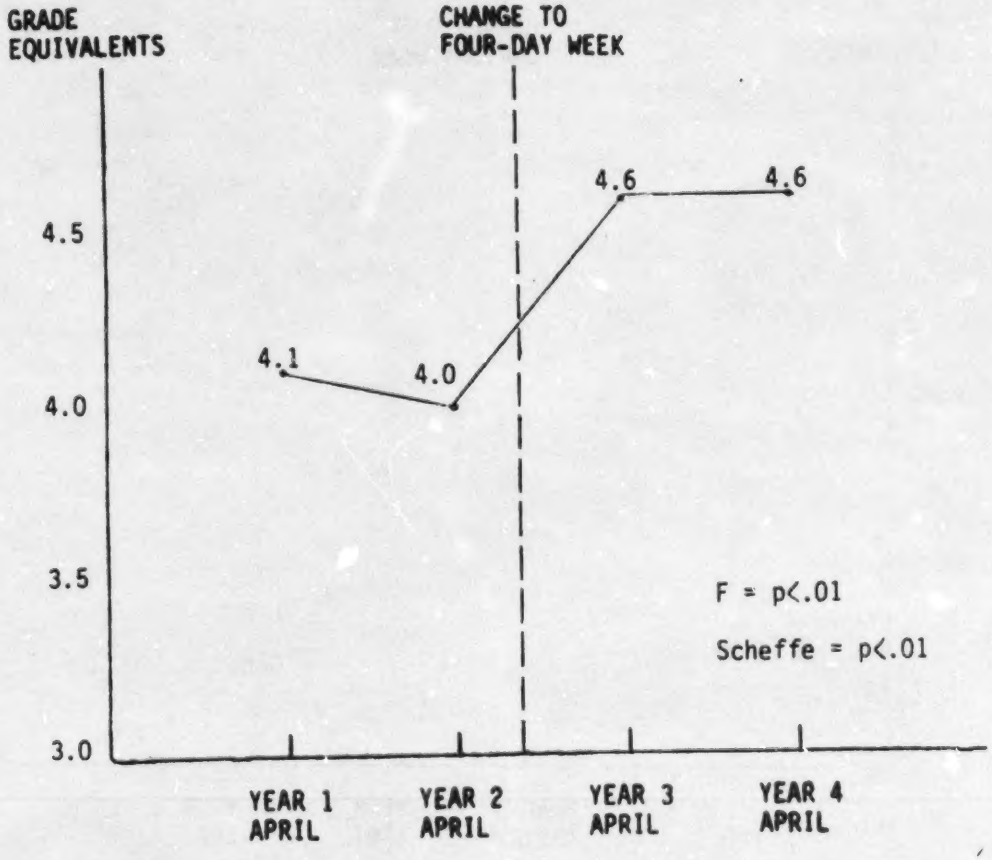

TABLE 20
PUNCTUATION - THIRD GRADE
Achievement Across Four Years

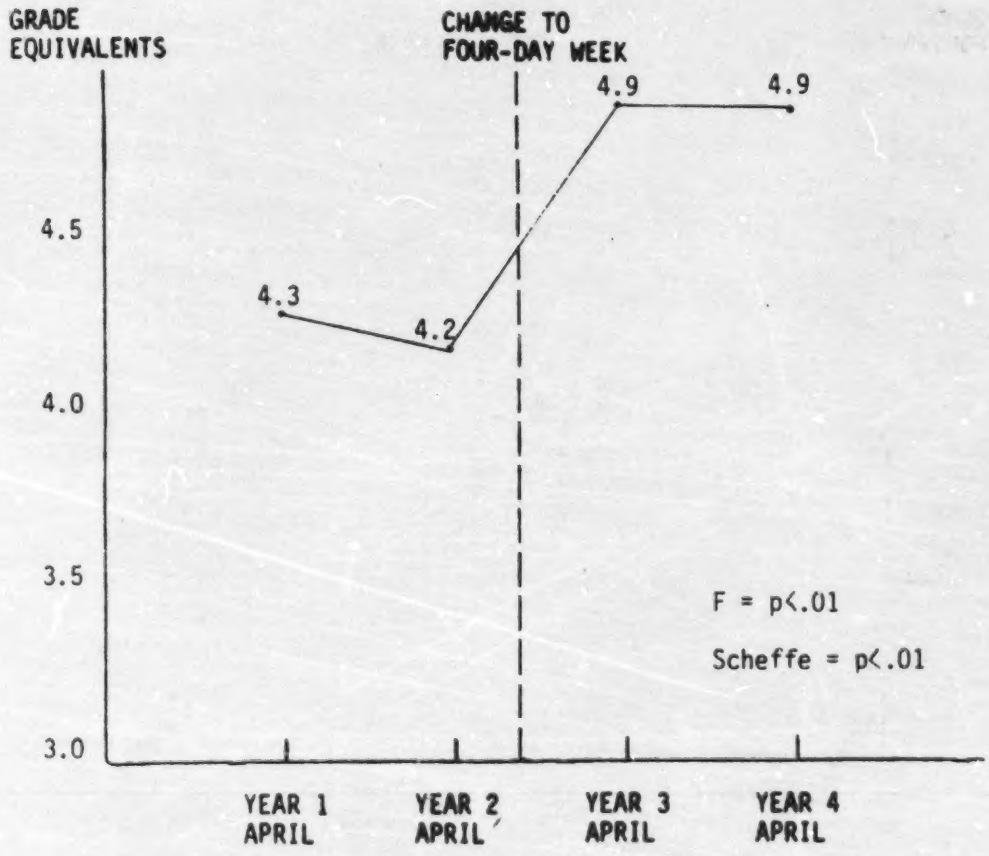

TABLE 22
VOCABULARY - FOURTH GRADE
Achievement Across Four Years

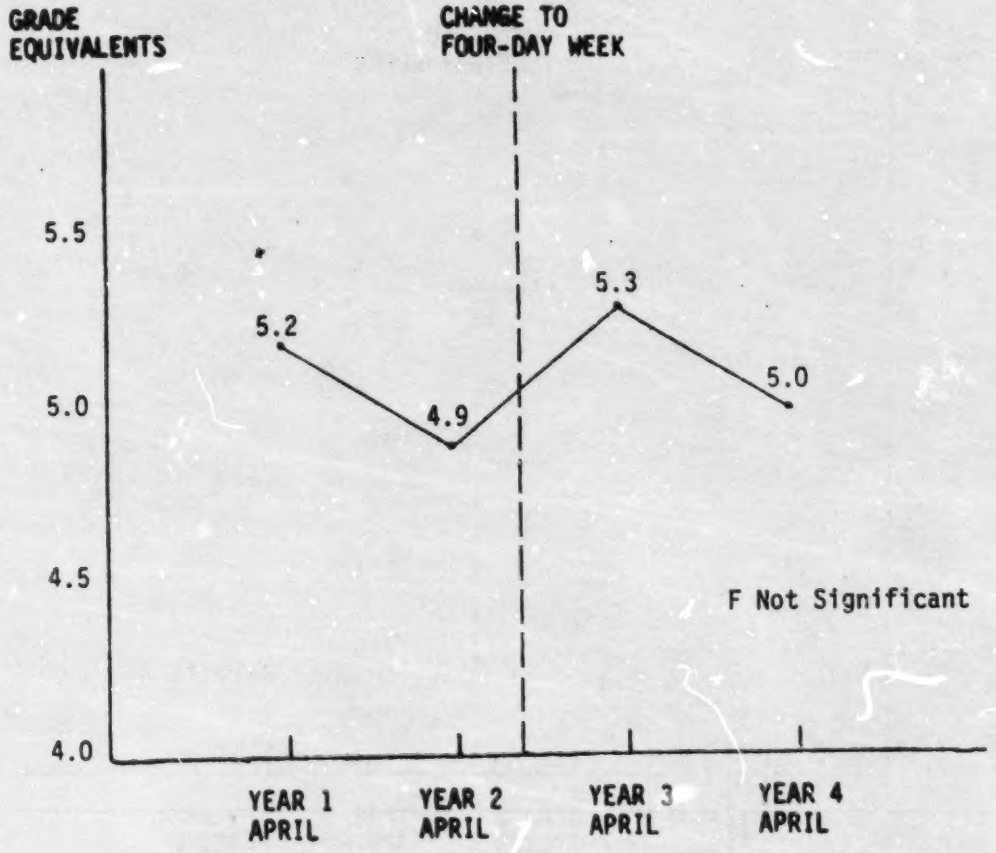

TABLE 23
READING - FOURTH GRADE
Achievement Across Four Years

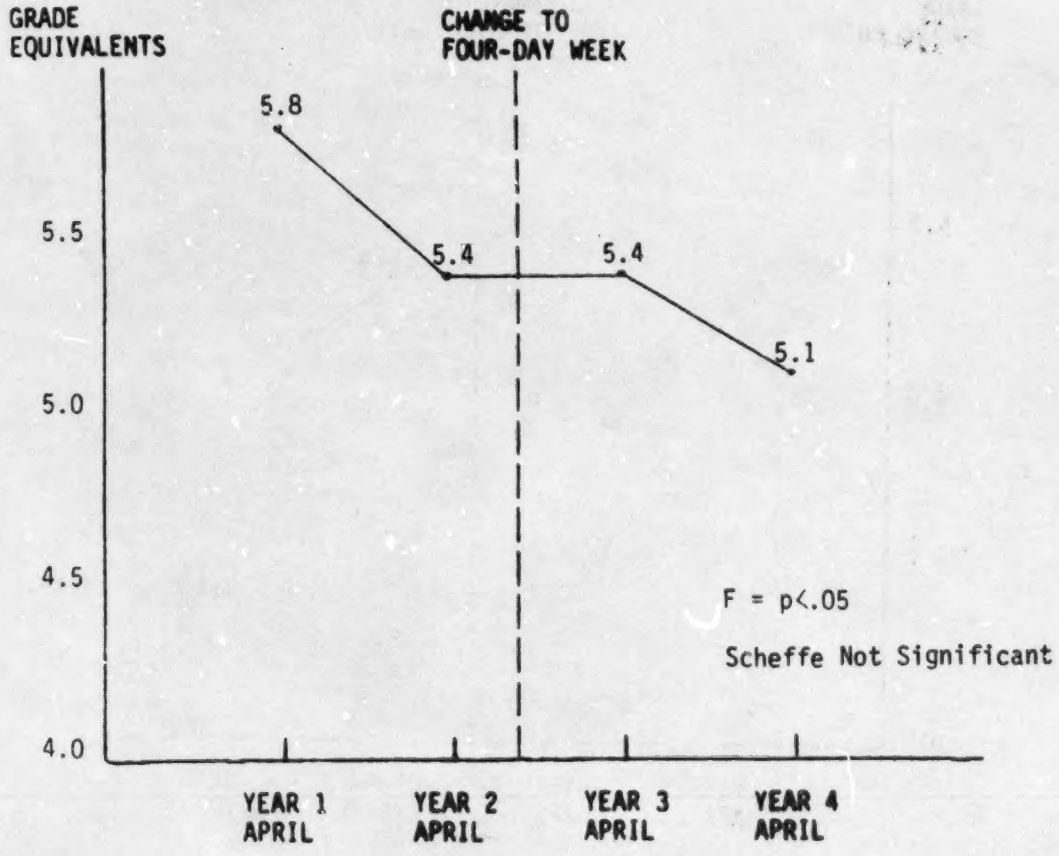

TABLE 24
LANGUAGE SKILLS - FOURTH GRADE
Achievement Across Four Years

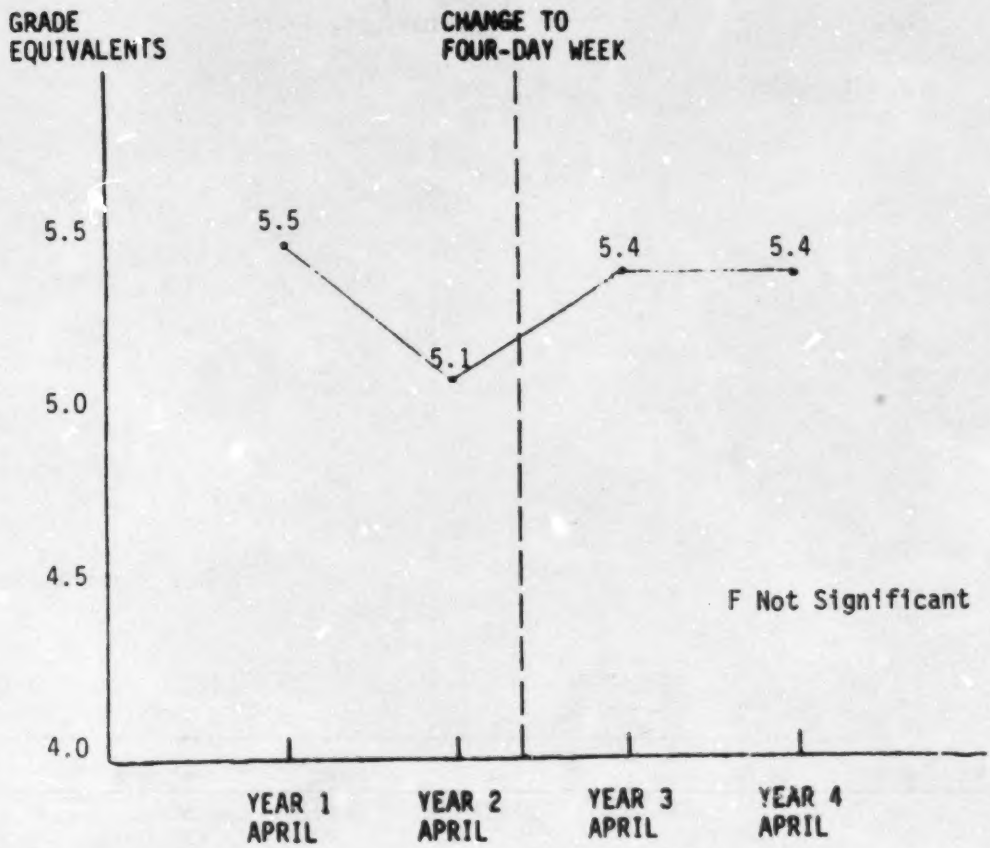

TABLE 25
WORK-STUDY SKILLS - FOURTH GRADE
Achievement Across Four Years

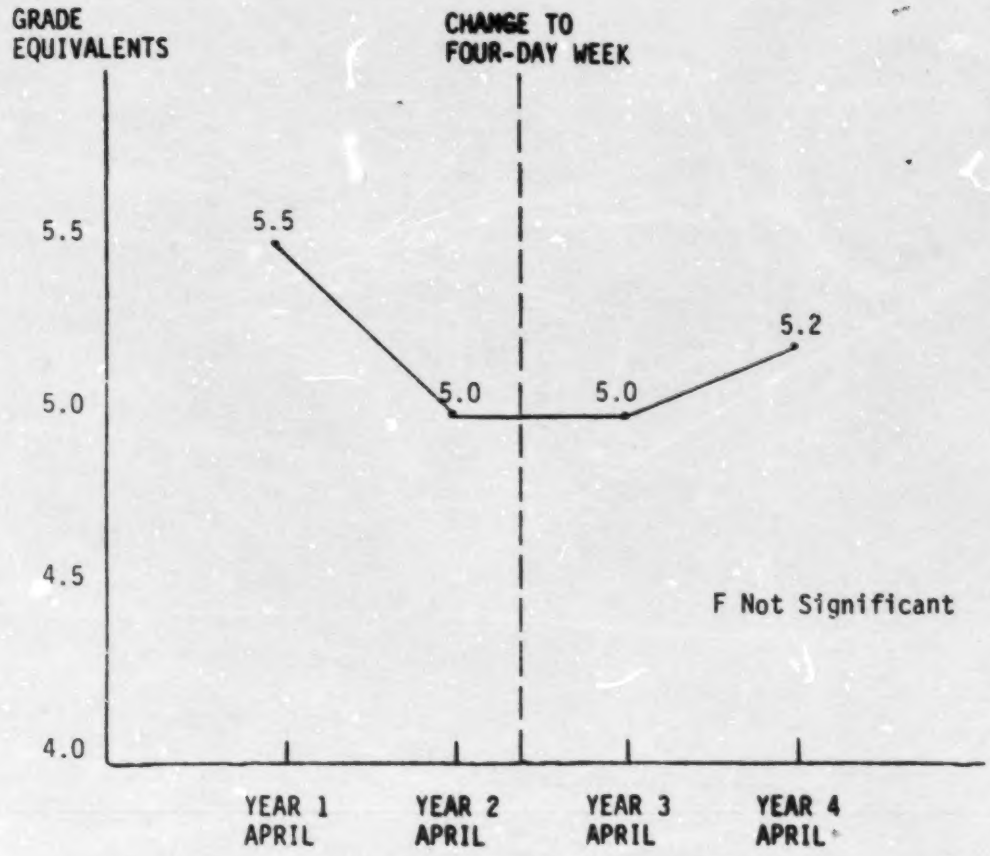

TABLE 26
MATHEMATICS SKILLS - FOURTH GRADE
Achievement Across Four Years

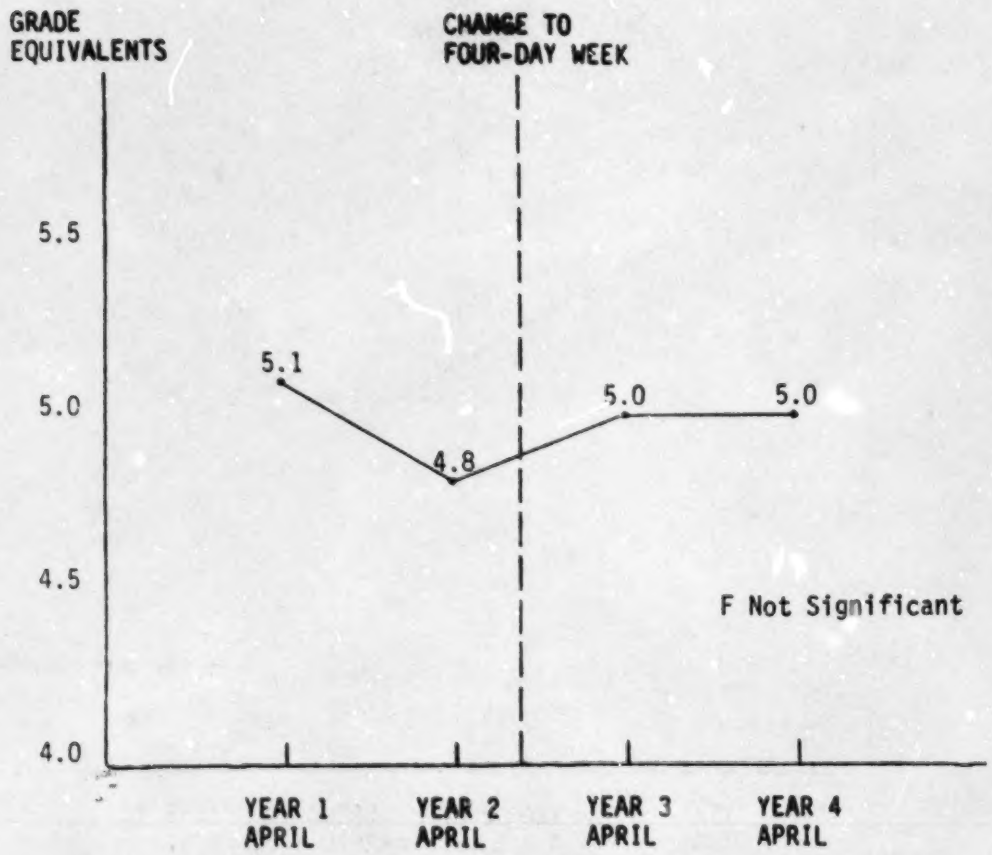

TABLE 28
VOCABULARY - FIFTH GRADE
Achievement Across Four Years

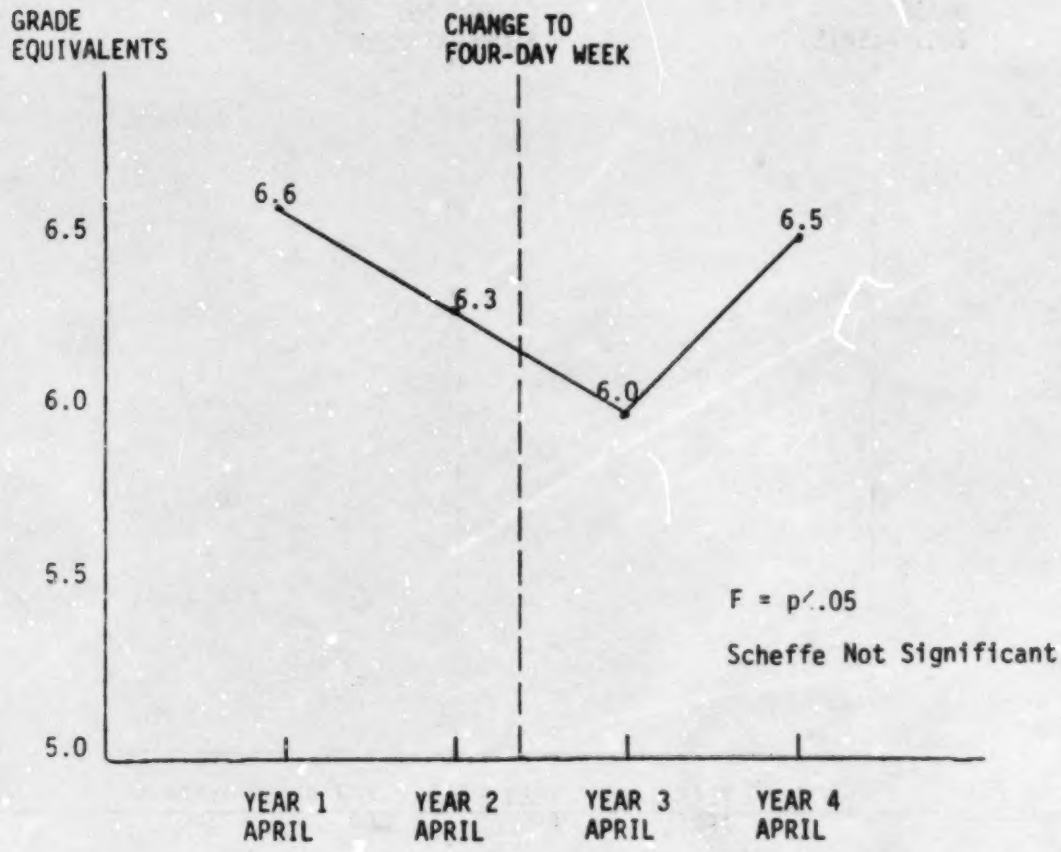

TABLE 29
READING - FIFTH GRADE
Achievement Across Four Years

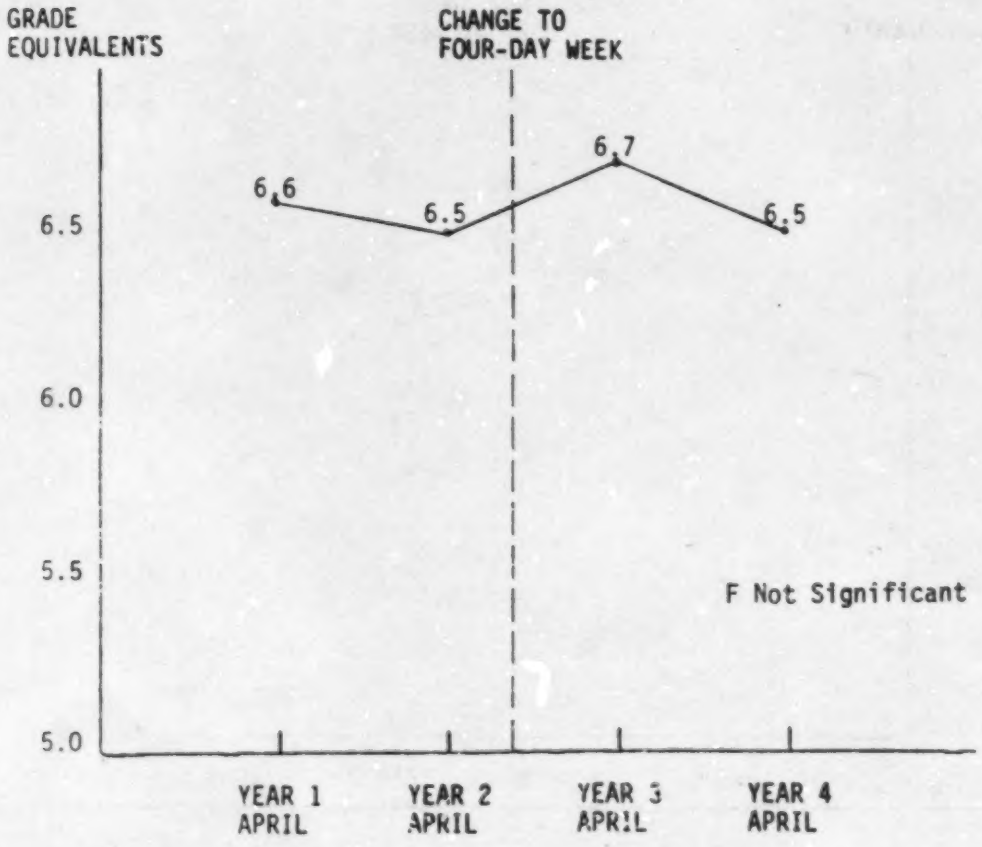

TABLE 30
WORK-STUDY SKILLS - FIFTH GRADE
Achievement Across Four Years

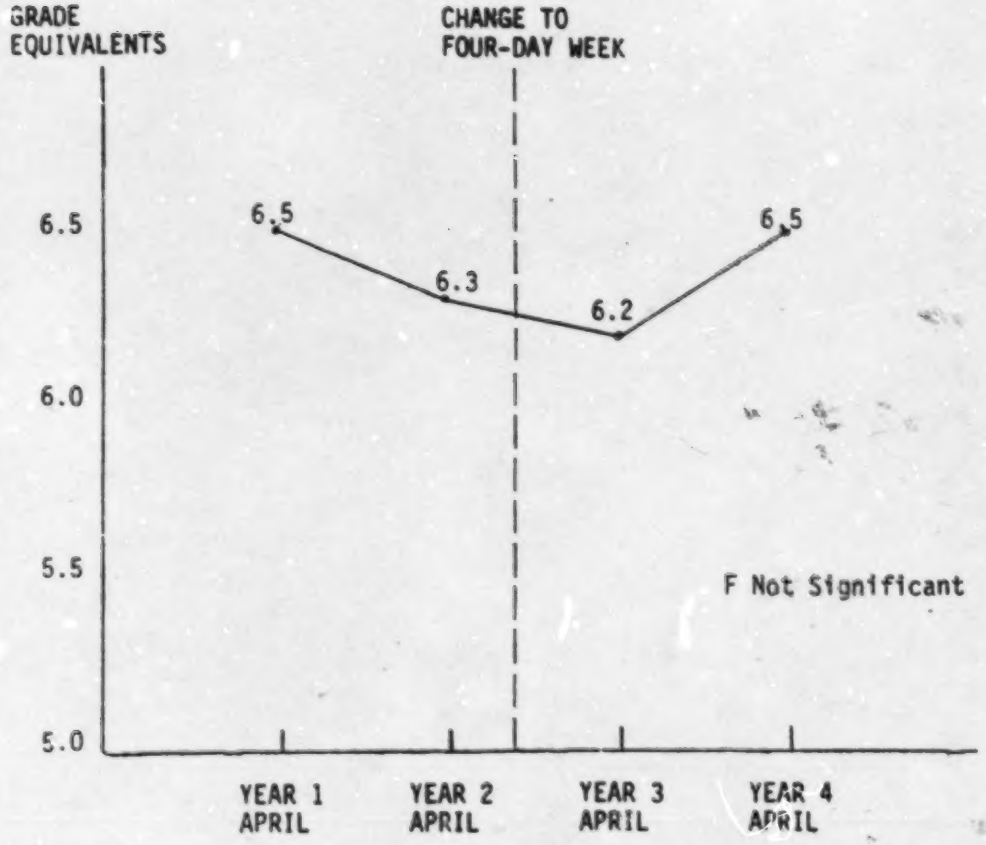

TABLE 31
LANGUAGE SKILLS - FIFTH GRADE
Achievement Across Four Years

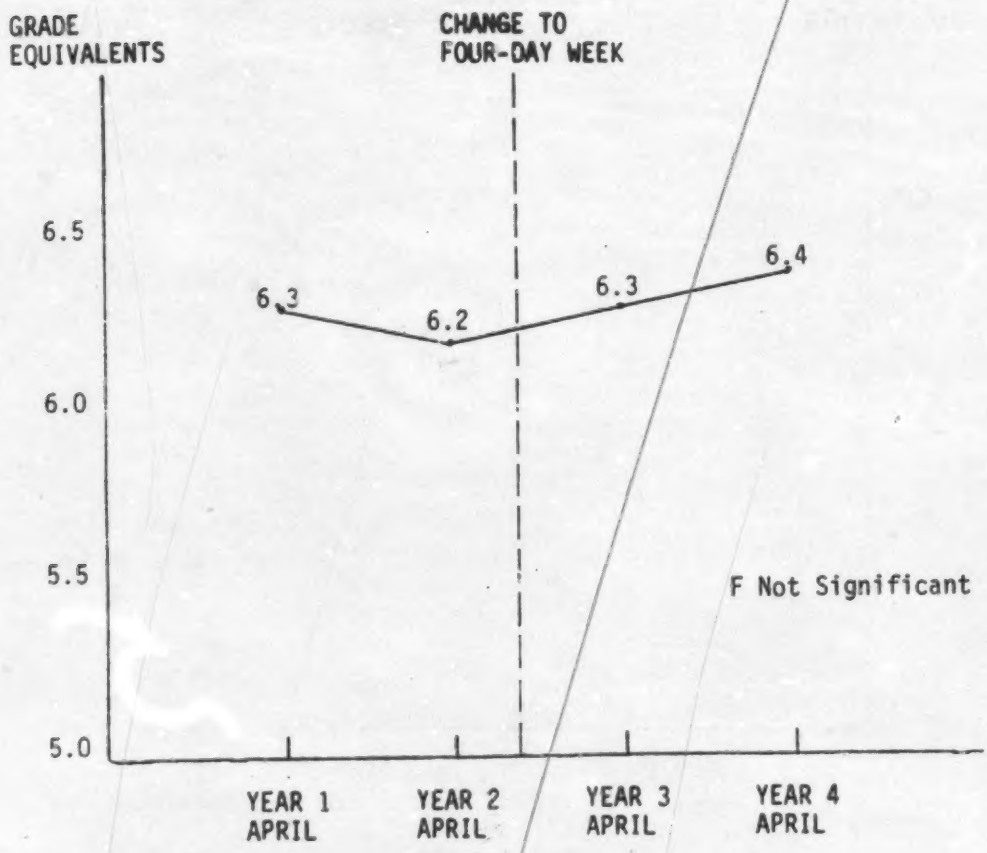

TABLE 32
MATHEMATICS SKILLS - FIFTH GRADE
Achievement Across Four Years

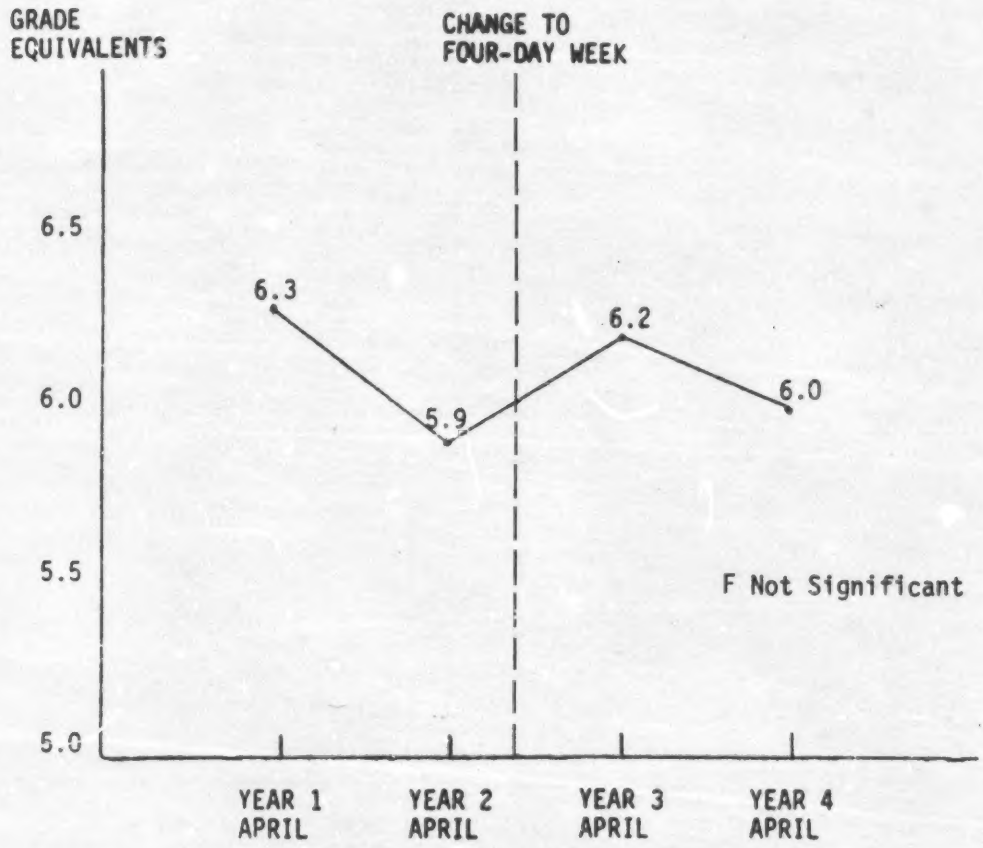

TABLE 34
VOCABULARY - SIXTH GRADE
Achievement Across Four Years

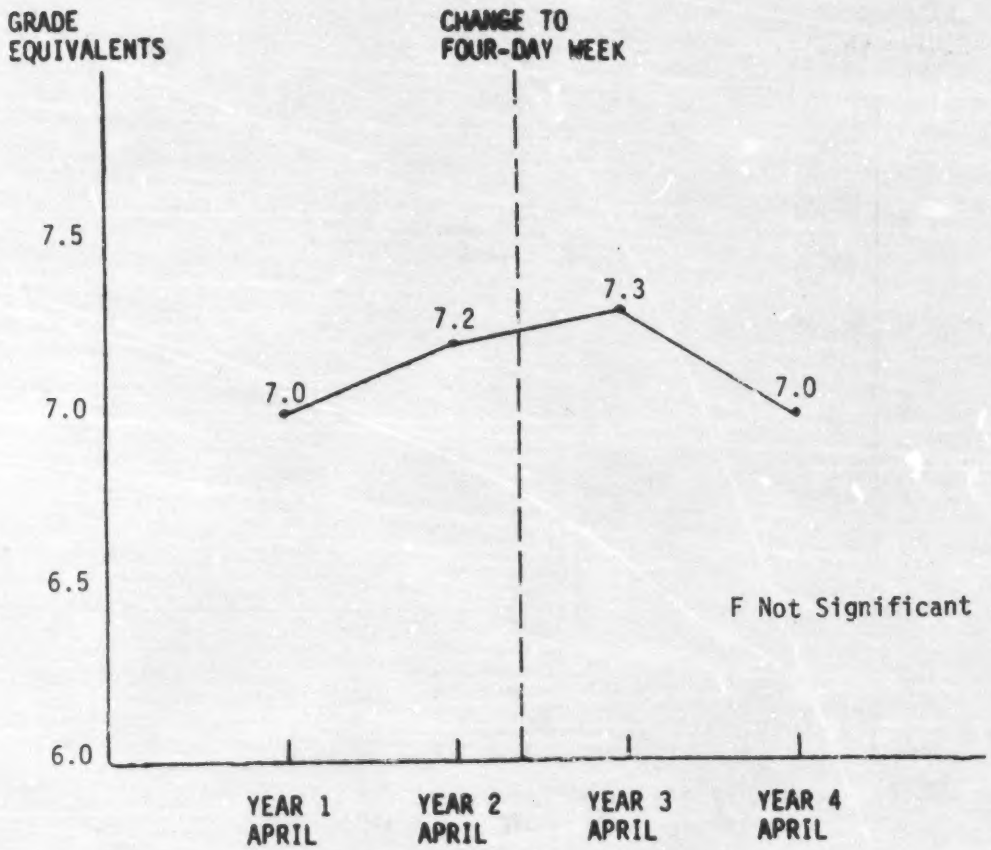

TABLE 35
READING - SIXTH GRADE
Achievement Across Four Years

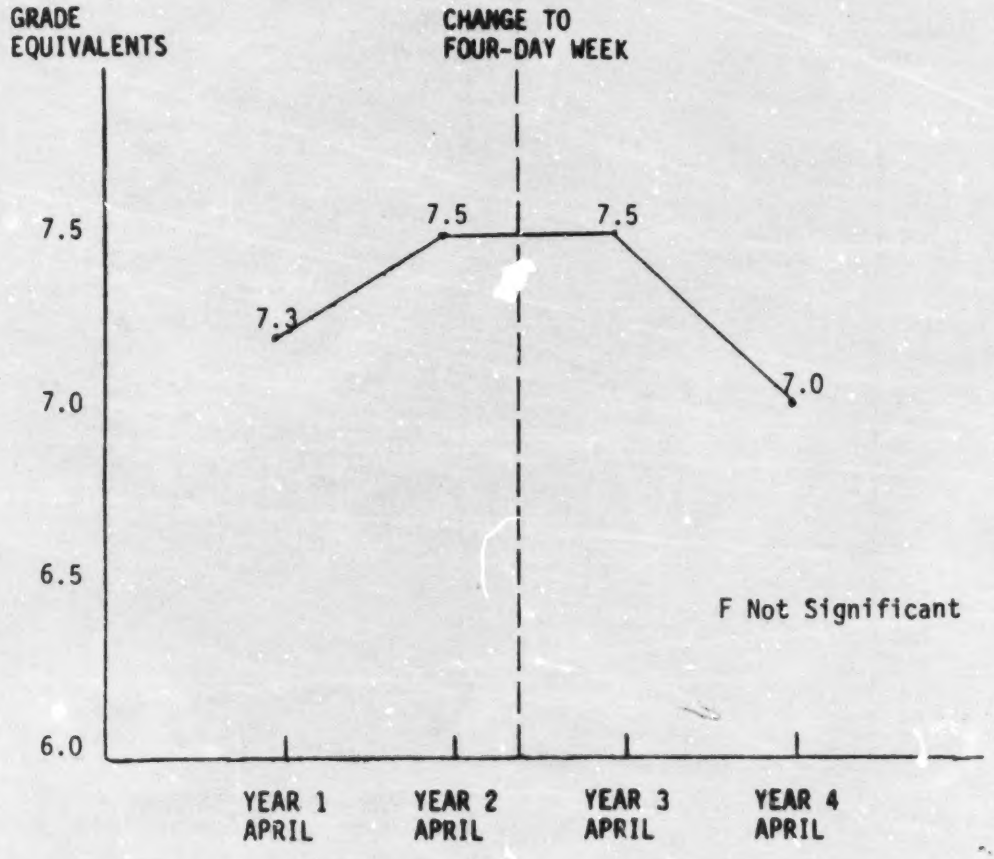

TABLE 36
LANGUAGE SKILLS - SIXTH GRADE
Achievement Across Four Years

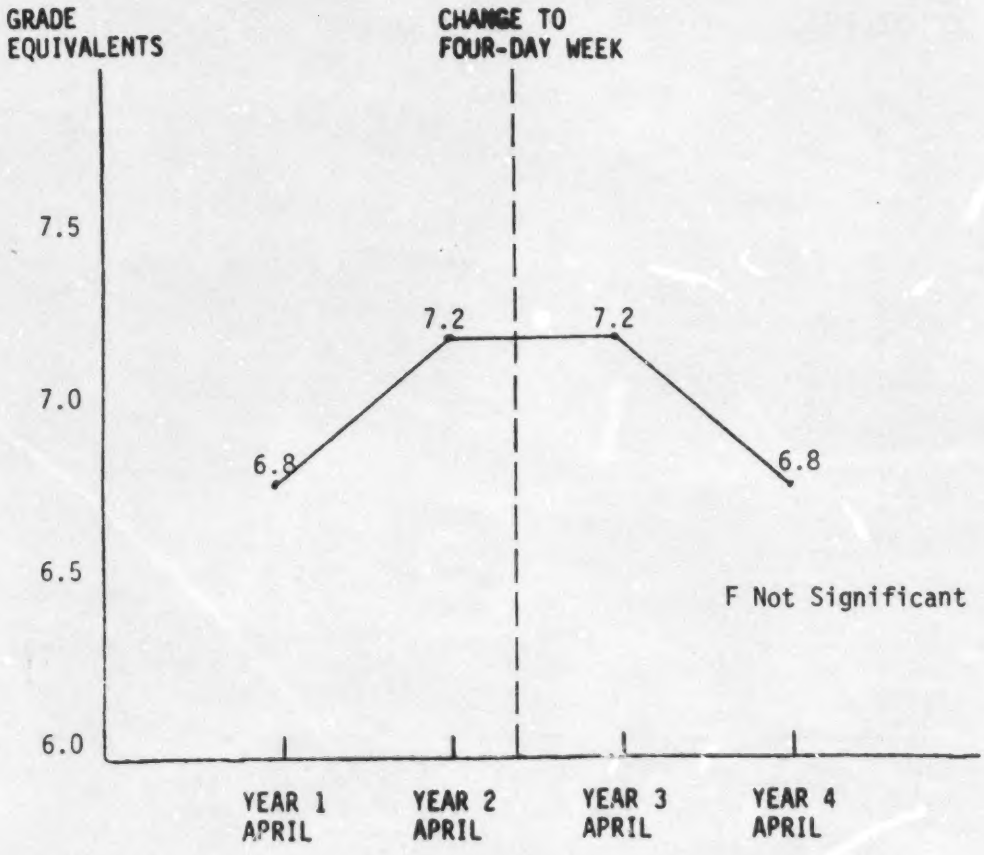

TABLE 37
WORK-STUDY SKILLS - SIXTH GRADE
Achievement Across Four Years

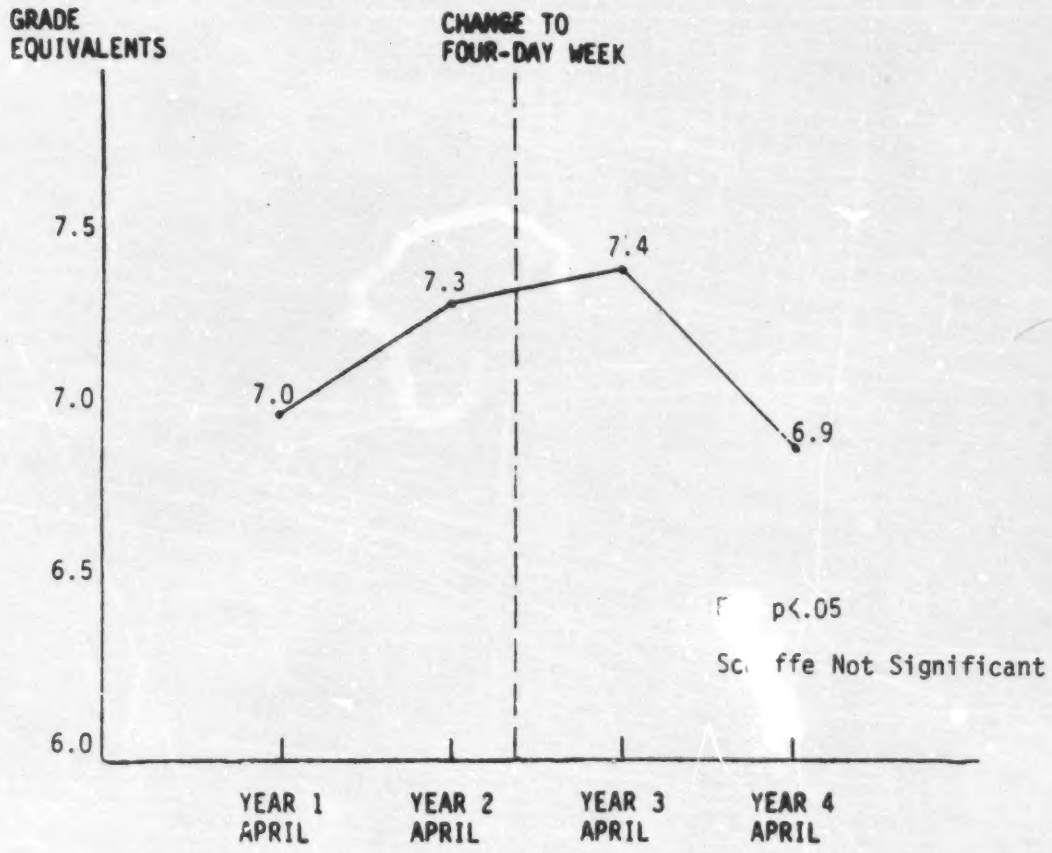

TABLE 38
MATHEMATICS SKILLS - SIXTH GRADE
Achievement Across Four Years